(Established 1832).

AMERICAN ENGINEER AND RAILROAD JOURNAL

PUBLISHED MONTHLY

BY

R. M. VAN ARSDALE.

J. S. BONSALL,
Business Manager.

140 NASSAU STREET NEW YORK.

G. M. BASFORD, Editor.
R. V. WRIGHT, Associate Editor.

MAY, 1905.

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A young man recently appointed superintendent of shops of a large road called at the editorial rooms of this journal. He was touring about the shops of the leading roads and asked for suggestions as to promising places to visit. After visiting three shops, which are far in the lead in applying improvements which make for increased production and output, he called again on his way home. He was astonished by what he had seen and was greatly surprised to find how far in advance of his own work others were.

This superintendent was not discouraged, but his trip had given him a new view of his work and he was led to see the importance of shop methods as well as equipment. It is impossible for any one to take an extended trip about railroad shops without learning a lot from the practice of others, and this is specially true now when new machinery, improved tool steels, and piece work are changing shop methods so radically.

The experience of this man was interesting for two reasons. The greatest number of improvements were found in a few shops, and those were far in the lead of all the rest. The shops in which most was learned were well equipped with new tools, but the advanced practice was by no means confined to the work done by these tools. The whole plant seemed to be tuned up to a high speed. The shafting speeds were high and everything seemed to move on a "step-lively" plan. It was also quite noticeable that much of the noteworthy records for output were being made on tools which were very old, and this was done through a careful study of machine capacity and the development of jigs and chucks for reducing the time of setting work. The time required to set work up in the machine is sometimes many times greater than that of doing the machine work itself, and devices for aiding the setting up are equally effective in old and new machines. This emphasizes the importance of developing shop methods for handling work into the machines.

If a shop foreman cannot get all of the new machinery he needs, he can profitably turn his attention to systems of jigs and devices for holding work in the machines which he has, for the purpose of setting up quickly and taking the heaviest possible cut the machines can carry. He will then be ready for new and better machinery when he is allowed to order it. A man who can handle inadequate equipment effectively is prepared to handle a shop with good equipment.

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ily reunion, a great deal of time would be saved to all because of the better understanding of the common problem upon which they are working. The greatest of the manufacturing organizations have learned the value of such conferences.

How often do the department heads of railroads meet the president? The possibilities of the inspiration they would derive from a quarterly meeting of a couple of hours are impressive. The writer was privileged to attend such a meeting of one of the largest manufacturing organizations, in which the men who secure the results met the highest officials, and briefly, tersely stated the condition of their work. The president gave a ten-minute review of what he was trying to accomplish, followed by some direct questions to each department officer. All present felt the strength of the organization to do the next thing better than it was ever done before. Each officer felt the importance of his own part and that of each other officer. Departmental lines disappeared in the general lines of the policy concerning all. What a power would such a plan engender in a large railroad organization! What an inspiration would come from such team work! How much better would the motive power official feel toward his work if he could make himself understood by the president, the operating and the purchasing officials!

RAILROAD WORK FOR COLLEGE MEN.

There are no keener observers of the progress of railroad men than the students in college who are considering railroad work as a possible profession. Those who are in position to know, say that there is now a tendency among technical school students to avoid the courses in railroad subjects in favor of other lines.

The students, even if greatly attracted toward railroad work, are naturally discouraged from entering it when they see a well-equipped, experienced and successful officer at the head of the motive power department leave the service for an important position in an industrial concern, where he receives a salary double or treble that of the railroad position. They naturally turn toward lines of less resistance, and it is an important fact that it is becoming necessary to urge these young men toward the railroads, as their inclination is plainly in other directions.

This fact is important, and it should receive the attention of railroad managers, directors, and all others concerned with the future of railroads.

These young men should not be urged against their inclinations. The point is, that the railroads should make attractive their mechanical work, so that the right young men will enter it as recruits.

Motive power problems to-day present the most interesting, attractive and inspiring work lying before those who are mechanically inclined. There is only one view to take of the future, and that is optimistic. The work to be done surpasses in importance any movement toward improvement in any other line of human activity. To improve transportation by advancing the locomotive to a higher development is naturally attractive to the brightest minds. This development is many-sided, and offers worlds of commercial and administrative, as well as mechanical, problems to be conquered.

Railroad managements will soon come to appreciate the motive power department, as presenting the greatest problems and the greatest possibilities connected with operation. In time, the chief of the motive power department will be so thoroughly appreciated as to render it impossible for him to be enticed into any other line of service. This situation will not come of itself, and it will come the sooner because of losing many good motive power men. It would come at once if these men in a body should tire of present conditions and simultaneously step out. Because of the assurance that this department will be recognized, appreciated and provided for, a word to the students may now be said.

No one who knows the conditions expects a change to come in a day. It will come, however, by the time present students are prepared to become officials, and the millennium will come sooner and in more perfect condition if a lot of bright, earnest young men put their experience into the service. No college boy cares to play in, or, for that matter, even to watch, a football game when the score is 56 to 0. We all know how night is turned into day, however, after a game of 4 or 6 to 0. The railroad game is not easy, but it is sure to bring results to the right men.

The field is ready. The results are sure. The railroads cannot afford longer to delay making motive work attractive and possible to the brightest young men, and the men they need most, when these young men are deciding upon their course in life. On the other hand, the young men should be led to see the possibility of bringing about the desired conditions by entering and patiently putting their lives into this work.

50-TON COAL CARS IN FRANCE.

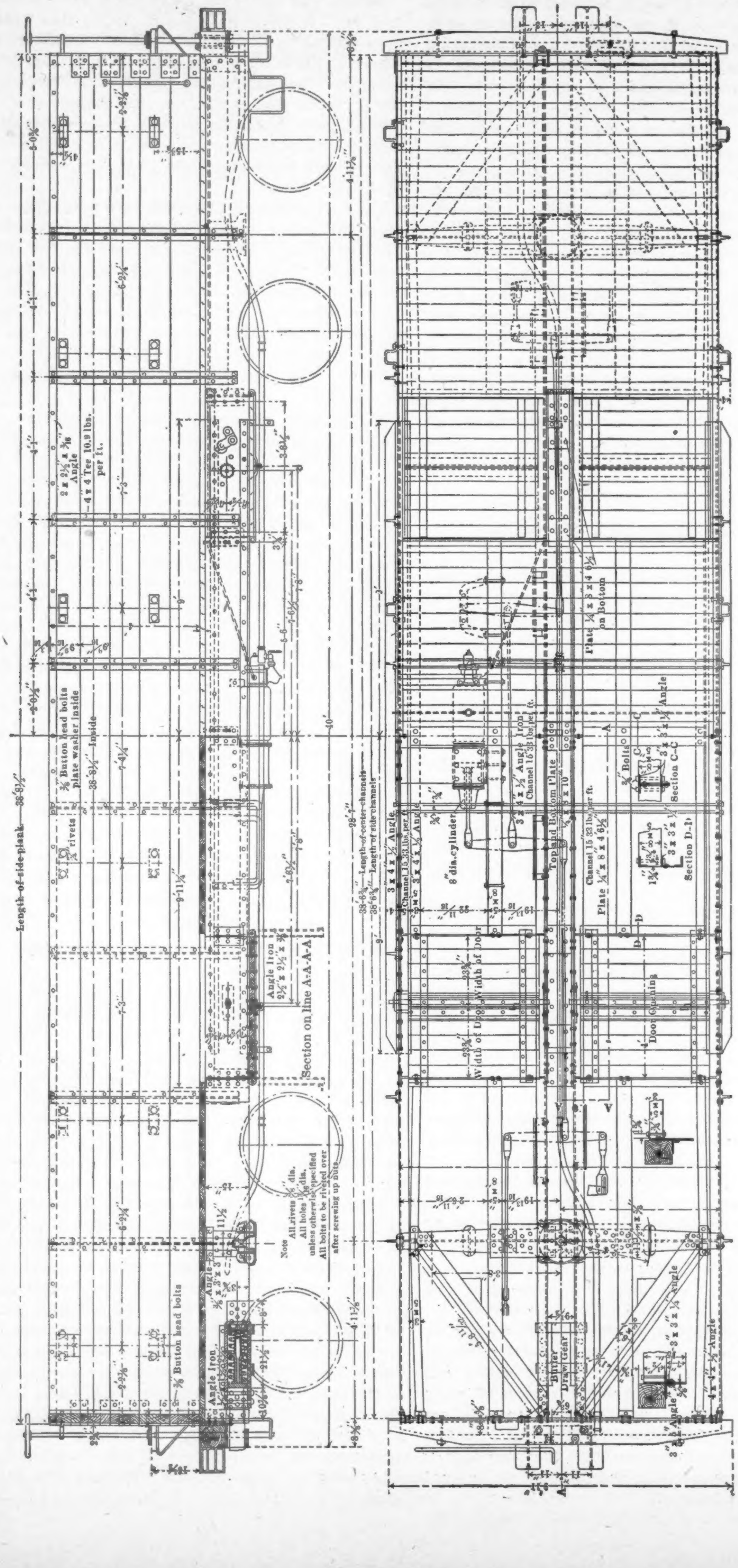
A movement has been started by the Southern Railway of France, in connection with the Carmaux coal mines and the Forges de Douai, to introduce 50-ton coal cars for coal and ore. These cars, which are illustrated and described in *Engineering*, are of the self-clearing hopper type, resembling the earlier forms of American cars of that form. These cars are 40 ft. 6 ins. long, and are carried on two 4-wheel Fox trucks. These cars have a cubic capacity of 2,048 cubic ft., and weigh 33,040 lbs. In addition to the hopper cars, the Southern Railway of France has introduced gondola cars for 50 tons of iron ore or 30 tons of coal. They have a capacity of 995 cu. ft., and weigh 33,936 lbs. The sides of these cars are of wood. The trucks have side frames resembling the Fox truck used in this country. These are joined together at the ends with cross members of pressed steel.

According to *Engineering*, "the test load, and which the bogie trucks are capable of carrying, has led the French companies to consider a reduction in the thickness of the steel plates, and to work in future for a ratio of 27 to 28 per cent. between the dead weight and the paying load. The Forges de Douai are contemplating a ratio of 25 per cent. when they are putting down presses for the manufacture of sills 65 ft. 7½ ins. in length." Such small ratios of dead to paying loads are worthy of special attention in American practice.

FIRE-PROOF CARS OF THE NEW YORK SUBWAY.

Destructive accidents seldom furnish such valuable information as a fire which occurred in the New York Subway March 29. In some way a train of five copper sheathed wooden cars (see American Engineer, March, 1903) and two of the new steel cars (see American Engineer, March, 1904) were set fire by collision with a bulkhead at the temporary end of the line. The heat drove everybody away and there were no fatalities or injuries. The fire after burning 24 hours, and consuming heavy timbering in the uncompleted end of the tunnel, burned itself out. The timbering of the tunnel was burned out and the five copper-sheathed wooden cars were entirely destroyed. The fire was hot enough to melt aluminum castings and fittings and to warp some of the plates, and yet the steel cars came through the fire in excellent condition.

Steel cars in the subway have also demonstrated their superior strength in a collision and together with the results of this fire the subway experience has thus far demonstrated the value of steel both for strength and for fireproof construction. The subway fire reproduced the conditions found in a furnace more nearly than those of a wrecked train burning in the open air. No stronger argument than this is necessary to direct attention to the very great advantages of steel in passenger car construction. It is to be hoped that the time is approaching when all new passenger cars will be built of steel.



100,000 LBS. STEEL UNDERFRAME DROP BOTTOM GONDOLA CAR—NORFOLK & WESTERN RAILWAY.

W. H. LEWIS, *Superintendent of Motive Power.*

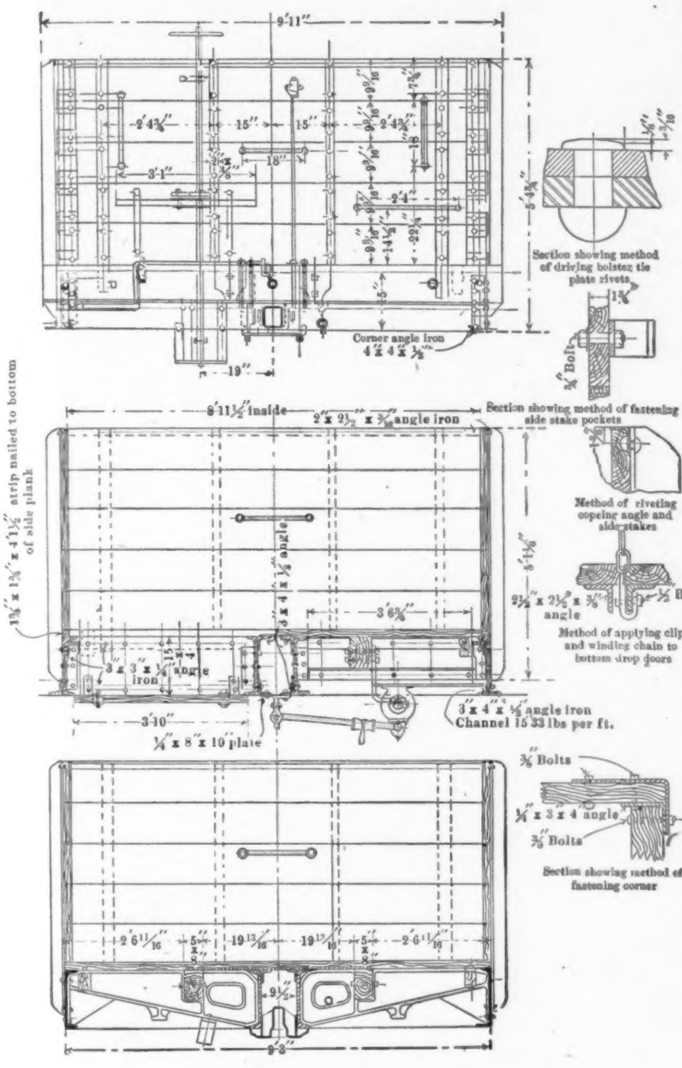
J. A. PILCHER, *Mechanical Engineer.*

STEEL UNDERFRAME DROP BOTTOM GONDOLA COAL CAR.

50 TONS CAPACITY.

NORFOLK & WESTERN RAILWAY.

In this journal in 1902, page 181, the 40-ton gondola coal car for this road, designated as class GG, was illustrated. In 1901, page 42, the 50-ton composite hopper coal car, class HG, was presented. The new design by Mr. John A. Pilcher, mechanical engineer of the road, is designated at class GI, illustrated herewith, is of 50 tons capacity with a steel underframe



CROSS-SECTIONS, NORFOLK & WESTERN GONDOLA CAR.

and relatively low (4-ft.) sides. The floor is flat with 4 drop doors. This new car differs materially from the designs of Mr. Seley previously mentioned. It has fixed ends and lower sides than the previous flat bottom gondolas. The new cars are intended for the shipment of lumber, and structural material, as well as coal. The following are the leading dimensions of class GI cars:

Length over end sills	40 ft. 0 ins.
Center to center of trucks	28 ft. 7 ins.
Length over body outside	38 ft. 8½ ins.
Length inside	38 ft. 2½ ins
Height of sides from under face of side sills	5 ft. 4¾ ins.
Depth inside	4 ft. 0 ins.
Width over all	9 ft. 11 ins.
Width over sides	9 ft. 3 ins.
Width inside	8 ft. 11¼ ins.
Weight, empty	38,800 lbs.
Weight of two trucks	15,060 lbs.
Weight of steel work	29,100 lbs.
Cubical capacity	1,447 cubic ft.
Ratio dead to paying load	35.3 %

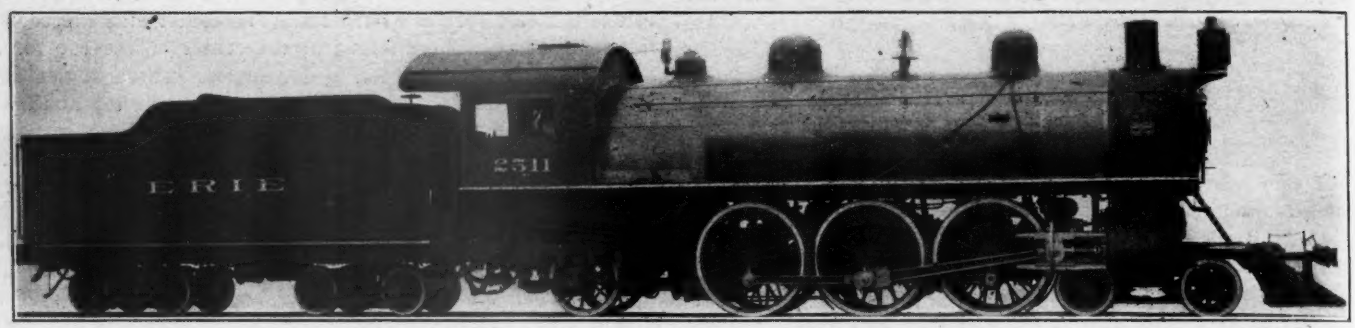
The new cars carry the load entirely by the underframe, in distinction to the two designs previously mentioned, which utilize the side frames as trusses. The center sills are of 15-in., 33-lb. channels, reinforced at the center of the car for a length of 18 ft. by 3 x 4 x ½-in. angles. These angles are riveted to the inside faces of the channels at the top and bottom, converting the channels into I beams at the central portion of the car. In addition to these angles the center sills have ¼ x 8 x 4 ft. 6 in. cover plates between the drop doors and 10 x 8-in. tie plates at the center of the car. The side sills are also 15-in., 33-lb. channels, reinforced with top and bottom 3 x 4 x ½-in. angles, through a distance of 18 ft. at the center of the car. The upper angles are inside of the channels and the lower angles outside, as shown in the sectional view. At the center of the car are diaphragms of plates and angles reaching from the center to the side sills. These are plate girders with two angles at the top and two at the bottom. At each door opening are plate diaphragms between the sills with single angles at the top and bottom. Between the drop doors and from the drop doors to the end sills 5 x 8 and 3 x 5 wooden floor stiffeners are employed, as shown in the plan. The doors are double, with openings 4 ft. x 3 ft. 7 ins. and closing against the lower faces of the side and center sills. The bolsters are of cast steel in two sections, riveted to the center and side sills, with pockets provided for the floor stiffeners to rest upon, as shown in one of the cross sectional views. Cover plates ⅝ x 11½ x 48 ins. are riveted to the tops of the bolsters and to the center sills. The ends of the bolsters have deep gussets, giving a substantial bearing for riveting to the side sills. The ends of the side sills are braced to the ends of the bolsters by ⅝ x 6-in. plates. The end sills proper are of ⅝ x 15-in. plates, carrying on their outer faces 5 x 3 x ½-in. angles, upon which the wooden end sills rest. The side stakes are 4 x 4-in. T's, 10.9 lbs. per ft.

This design embodies a very substantial underframe in a car weighing 38,800 lbs. The coal service on this road is very severe, as the cars frequently make 5,000 miles a month, running on the Norfolk & Western lines, chiefly between the mines and tidewater. That this road is using composite construction and steel underframes exclusively for new coal cars is an argument in favor of steel construction. The first car constructed from these drawings was loaded with 117,100 lbs. of coal, giving a deflection of 0.64 in. of the side sills and 0.76 in. of the center sills, measured at the center of the car. These figures confirmed the calculated deflections almost exactly. We are indebted to Mr. John A. Pilcher for the drawings.

OPEN-TOP OBSERVATION CARS.

The Denver & Rio Grande Railroad Company is now building a number of open-top observation cars to be attached during the summer months to daylight trains running through the Royal Gorge, Grand Canon of the Arkansas, Canon of the Grand River and the Black Canon of the Gunnison. These cars are of modern construction and have a seating capacity for seventy-two persons, low sides but no tops, being entirely open, thus giving a free and unobstructed view of the scenery of the Rocky Mountains. These cars will be completed and placed in service June 1 of the present year.

OWNERSHIP OF HOMES BY RAILROAD EMPLOYEES.—A scheme to encourage the ownership of land by the employees of the St. Louis, Browville & Mexico Railroad has just been put into effect, by which a land syndicate will sell five or ten acres of ground along the line of the road to employees at a fair price and on liberal terms. Water is supplied by the company and the families of the employees are protected. In case an employee is killed in the service, the land is to be deeded to his wife or family without further payment. In case an employee owning land leaves the service the land company will refund money paid upon the land and interest upon it at the same rate as he was charged for it. The plan seems to have excellent features, and it is hoped it will be an entire success.



PASSENGER LOCOMOTIVE WITH SUPERHEATER—ERIE RAILROAD.

4—6—2 (PACIFIC TYPE.)

In order to cope with trains of increasing weight the Erie Railroad has added to its locomotive equipment balanced compound locomotives, one of which is illustrated in this number, and also a very heavy and powerful 4—6—2 type locomotive with Cole superheater. The latter locomotive, recently completed at the Schenectady Works of the American Locomotive Company, has a total weight of 230,500 lbs. This engine has a tractive effort of 30,000 lbs. and a superheater of unusually large capacity, the heating surface of the superheater being 763.75 sq. ft., while the boiler heating surface is 3,321 sq. ft. It is, perhaps, hardly fair to add these two heating surfaces together, and say that the total heating surface is 4,084 sq. ft., but the figures added together give that amount, which is larger than has ever before been provided in a locomotive for passenger service, the largest boiler heating surface, without a superheater, for passenger service being that of the Pacific type locomotive of the Chicago & Alton, illustrated in March, 1903, page 87, which had 4,078 sq. ft. It is believed that the surface of the superheater is very much more effective in increasing the boiler capacity than the same amount of surface added to the boiler, therefore it may properly be stated that this is the most powerful boiler ever given to a passenger engine. The Erie Railroad has work for such an engine to do, and the performance records will be watched with the greatest interest. The superheater is of special interest, and will be illustrated next month. This boiler has 20-ft. tubes, which are only 1 ft. shorter than those of the Mallet compound of the Baltimore & Ohio, illustrated in June, 1904, page 237.

On April 24th engine No. 2512, which is exactly like the one illustrated except that it is not equipped with a superheater, made a remarkable run with a very heavy passenger train from Jersey City to Port Jervis. The data for this run are not yet completed, and will be referred to next month in connection with the description of the superheater of locomotive No. 2511.

The chief dimensions of the superheater locomotive are as follows:

4—6—2 PASSENGER LOCOMOTIVE—ERIE RAILROAD.

GENERAL DATA.	
Gauge	4 ft. 8½ ins.
Service	Passenger.
Fuel	Bituminous coal.
Tractive power	30,000 lbs.
Weight in working order	230,500 lbs.
Weight on drivers	149,000 lbs.
Weight of engine and tender in working order	393,500 lbs.
Wheel base, driving	17 ft.
Wheel base, total	33 ft. 8 ins.
Wheel base, engine and tender	65 ft. 1 in.
RATIOS.	
Tractive weight ÷ tractive effort	4.9
Tractive effort x diam. drivers ÷ heating surface	669
Heating surface ÷ grate area	58.7
Total weight ÷ tractive effort	7.6
CYLINDERS.	
Kind	Simple.
Diameter and stroke	22½ by 26 ins.
Piston rod, diameter	3¾ ins.
VALVES.	
Kind	12-in. piston.
Greatest travel	6 ins.
Outside lap	1 in.
Inside clearance	⅛ in.
Lead in full gear	line and line.
Lead at ½ stroke	¼ in.
WHEELS	
Driving, diameter over tires	74 ins.
Driving, thickness of tires	3½ ins.
Driving journals, main, diameter and length	9½ by 12 ins.
Engine truck wheels, diameter	36 ins.
Engine truck, journals	6½ by 12 ins.
Trailing truck wheels, diameter	50 ins.
Trailing trucks, journals	8 by 14 ins.
BOILER.	
Style	Straight top.
Working pressure	200 lbs.
Outside diameter of first ring	74⅝ ins.
Firebox, length and width	108 by 75 ins.
Firebox plates, thickness	⅜ and ½ in.
Firebox, water space	4½ ins.
Tubes, number and outside diameter	195 2-in.; 32 5-in.
Tubes, gauge and length	No. 11, 20 ft.
Heating surface, tubes	3,119 sq. ft.
Heating surface, firebox	202 sq. ft.
Heating surface, total	3,321 sq. ft.
Superheater heating surface	763 sq. ft.
Grate area	56.5 sq. ft.
Exhaust pipe	Single.
Smokestock, diameter	18 ins.
Smokestack, height above rail	15 ft. 2¼ ins.
Centre of boiler above rail	113½ ins.
TENDER.	
Wheels, diameter	33 ins.
Journals, diameter and length	5½ by 10 ins.
Water capacity	8,500 gals.
Coal capacity	16 tons.

AIR-BRAKE ASSOCIATION.

At the twelfth annual convention, held in New Orleans April 11, this association gave its attention to a number of papers. The first, on oil cups and air strainers, by C. H. Larimer, directed attention to the necessity for improvement in the lubrication of air pumps, which is becoming more important with the increased duty expected of these pumps. As a necessary adjunct of the proper lubrication of the air cylinders, improved strainers with larger air inlets were advocated.

Train pipe leakage was the subject of a report by Messrs. B. J. Langen and W. C. Hunter. With the increase of the weight of trains leakage has become a very serious matter and because of leakage engineers have been known to shut off steam at least a mile from the siding they were to enter in order to avoid using the brake and prevent the brake sticking and the train breaking in two. Experiments were described for the purpose of showing the effect of train pipe leakage. With a train of 55 cars a leakage reducing the pressure 4½ lbs. per minute was shown to be too great for successful handling of trains on long grades. The committee recommended eleven remedies, directed towards the improvement of the situation, which is becoming serious.

In a paper on air hose Mr. Robert Burgess cited the case of a railroad having 25,000 cars on which the cost of maintaining hose for a year was $30,000, this if capitalized at 5 per cent., represented an investment of $600,000. The attention of the association to this subject through the investigation of a committee was recommended.

Mr. L. M. Carlton, in a paper on brake rigging design, stated that the design of foundation brake rigging had become standardized along lines which while satisfactory in the days of small cars, were not as satisfactory on heavier cars, particular attention being given to the harmonious action of the hand and air brakes. He not only advocated hand brakes which would work in harmony with the air brake, but believed that better hand brakes were wanted.

In the closing paper Mr. F. M. Nellis, secretary of the association, presented an important discussion on the unbraked weight of cars. He strongly supported the method of making

a predetermined allowance of 1,500 lbs. unbraked weight per axle regardless of the weight of a car, this being preferable to an allowance of a certain percentage of the actual weight of the car to be left unbraked. He supported this argument by those recently made on an experimental train on the New York, Ontario and Western Railroad, in which the cars varied in weight from 46,000 to 103,000 lbs., the unusual variation being provided for by the proper use of 10, 12, 14 and 16-in. cylinders. Mr. Nellis raised the important question of basing the braking upon service instead of emergency application, believing that we should reverse the usual way and give primary attention to the service feature of the brake, because hundreds of service applications are made to one emergency application. Experiments referred to have shown that it is possible to entirely eliminate slid flat wheels in passenger equipment. He left the subject of similar treatment of freight braking to a future paper.

APPLICATION OF THE NEW MANTLE LAMP USING PINTSCH GAS.

LOCOMOTIVE TESTING PLANT IN BERLIN.—It is reported that the Prussian Government Railways will install a stationary locomotive testing plant at Berlin, with a view to studying water, fuel and lubrication consumption and under all possible conditions of service.

A GREAT IMPROVEMENT IN CAR LIGHTING.

While important improvements have been made in the devices for illuminating passenger cars during the past few years, there is a demand from many quarters for more light under economical conditions. The Pintsch Company has now met this demand after two years of experimenting, and have placed in service a lamp of special design, which brings into use a mantle of unique and original form or shape. This mantle is of an inverted type, about 1 in. in diameter, and is so arranged as to provide a suitable jet. The lamps are illustrated as applied to a Pullman sleeping car, and the mantles used, which give a soft, white light, are contained inside of the globes; the mantle and globe being so fixed together that they are fastened to the lamp proper by means of a screw socket as readily as an incandescent lamp can be put in place.

The results obtained can be appreciated when it is understood that the illumination given is 33 candles per foot of Pintsch gas used, or an efficiency of about three times that given by the present standard Pintsch lamp for the same consumption of gas, and actual service tests indicate that the life of the mantle is at least three months. The ease of renewing the mantles, the absolutely smokeless flame and the cleanliness insured add to the list of advantages which should be mentioned. The simplicity, efficiency and economy of the Pintsch system are retained in using this light, and in cases where it is decided to adopt the new light a very important saving would be made, because the lighting equipment as now used on the majority of cars throughout the country is available, and only the small cost of renewing the lamp fixtures is involved.

As the working parts of the lamp are simple and compact, the ornamental features will not be limited thereby, and as the illustration shows, the lamp can be made to enter largely into the decorative scheme of the car.

The further extension of supply stations of the Pintsch Company during the last year makes the gas available in all parts of the United States, Canada and Mexico, and at places where only a small supply is required the policy of the company is to furnish transport holders to be placed on flat cars running to the gas plants for charging.

BALTIMORE & OHIO WATER SERVICE.

The Baltimore & Ohio Railroad is making extensive improvements in the supply of water for use in its locomotives. President Murray has recently authorized improvements on the line of the system between Connellsville and Pittsburg, which includes the establishing of water treating plants at Emblem and Glenwood. This work will cost in the neighborhood of $150,000. At Layton the present reservoir capacity will be increased. At Griffin a fairly good mountain stream has been located, which is to be dammed and furnish water at this point by gravity. At Emblem it will be necessary to continue the use of the river water, and, to use this

satisfactorily, a purifying plant of 30,000 gals. capacity per hour is to be installed. This plant will also furnish a supply of water that will be carried to Versailles by gravity. At Glenwood it is also necessary to use the river water, and a purifying plant of about 100,000 gals. capacity per hour will be constructed. At Delmar, the Allegheny River water will be piped to suitable storage tanks. The recent annual droughts in this district have resulted in the river waters becoming badly contaminated and polluted by the refuse from mines, mills and decaying of animal and vegetable matter, and this has resulted not only in the scarcity of supply, but in a water that is entirely unfit for locomotive purposes, and the consequence has been an unlimited expense and delay in the handling and maintenance of power, and in the movement of traffic. Where an ample supply of water is available, the best method is to provide reservoirs of sufficient capacity to tide over during the dry season and to supply water by gravity during the entire year. At quite a number of places such a supply cannot be provided, and in these cases it is necessary to make use of the river waters, and treat them by a combined mechanical and chemical process in order to eliminate the impurities and acids, which attack the sheets and flues of locomotive boilers, causing serious leakage and other interference with the movement of the power. The making of these improvements in the source of supply, and for the treatment of impure waters, will relieve the conditions that have existed in this district each fall for some years past, and will enable the more prompt movement of the traffic during the fall and winter season.

APPRENTICE EDUCATION—LONDON & SOUTHWESTERN RAILWAY.

In March, 1903, Mr. D. Drummond, locomotive engineer of the London & Southwestern Railway, instituted a plan (see American Engineer, February, 1904, page 49) for sending apprentices, during working hours and at the expense of the company, to the Battersea Polytechnic Institute for special courses of instruction. This school is near the Nine Elms shops of this road and the boys return to the shops from the school. Mr. Sidney H. Wells, principal of the school, gives the following account of experience with this plan:

"This year, 87 apprentices are in attendance at classes, being divided into three sets, A, B and C. Set A numbers 13 students, and as they attended for a first year course last year, they are now taking a second year course as follows: Tuesdays, 8 to 9, practical mathematics, Stage II.; Fridays, 8 to 10.30, steam and heat engines, lectures one hour followed by laboratory class of 1½ hours. The work taken by this class last year was first year applied mechanics and practical mathematics. Set B numbers 28, and attends on Mondays, 8 to 9, for practical mathematics, and Wednesdays, 8 to 9.30, for applied mechanics. The majority of these also attended last year for the same subjects in a more elementary stage. Set C numbers 46 students who attend this year for the first time. They take elementary practical mathematics on Thursdays, 8 to 9, and elementary applied mechanics on Saturdays, 8 to 9.30.

"The apprentices attend the classes at the times stated instead of going to the works from 6 a. m., and they return to the works after leaving the classes. Their wages are paid by the company as though present at the works from 6 a. m., and the company also pays the class and examination fees. Home work is set regularly and is required to be done by all the students.

"We are now nearing the end of our second year's work with these classes, and we can only say that, in our opinion, they are far in advance of evening classes with regard to punctuality and regularity of attendance, performance of home work, interest displayed, and in quantity and quality of work got through. The company gives prizes to the students who stand highest at the yearly examinations, and I believe it is proposed to give the best students, after a three years' course here, the opportunity of taking a higher or university course at a day college with a view to taking an engineering degree.

"This experiment of early morning classes for apprentices is, I believe, the first of its kind to be tried in this country, and I think very great credit is due to the London & Southwestern Railway and to Mr. Drummond for undertaking it; if only that it shows the apprentices that the company is really interested in their securing technical education, the movement does immense service. There is no doubt that much better work can be done in such classes than in evening classes, where the apprentices are naturally physically tired after the day's work."

IMPROVEMENTS IN SLEEPING CARS.

An improved sleeping car, brought out by the American Palace Car Company, which has been operated in this country for several years, merits serious attention by those who desire to improve sleeping cars. For twenty years there has been no permanent improvement in principle in the sleepers operated on American railroads. The system of the American Palace Car Company embodies all of the improvements and improved facilities of the Pullman sleeping cars and the Pullman parlor cars contained in one car, which, in the daytime, is provided with movable chairs, and at night is made up into berth sections, the chairs being stowed below the floor in the spaces occupied by the berth sections when those sections are not in use; thus the earning capacity of two cars is represented in the cost of construction of one. The construction of the car permits of a thorough and complete system of ventilation, which thus far has never been accomplished in a Pullman car. In this improved car the upper berth offers the same advantages of light, air and observation as that provided in the lower berth, the upper berth, therefore, becoming a comfortable space instead of a disagreeable box. The new car provides berth supports from below, leaving the side of the car free for an extension of the windows of from 10 to 12 ins. above the top of the berth. The upper berths are removed from the interior of the car during the daytime and stowed with the lower berths in steel berth pockets under the floor. In the daytime, instead of the fixed seats, half of which face the rear, the passengers are all provided with comfortable chairs, which may be moved about. Sections may be made up in three minutes, and the lower berth is a comfortable bed instead of a hard sofa. The car differs from ordinary construction in extending the body below the floor between the trucks, in order to provide space for the berths to collapse into during the daytime. This car is one which should interest railway officials, because it possesses very desirable improvements.

Waste Gas in Coking Coal.—In the coking of 1 ton of coal there become available, and are only too frequently wasted, about 2,500,000 British thermal units, sufficient to develop in gas engines at least 205 effective h.p. hours. Thus, for every 11 lbs. of coal coked per hour 1 effective h.p. is available as a by-product.—*Mr. Max Rotter, Illinois Steel Works Scientific Club.*

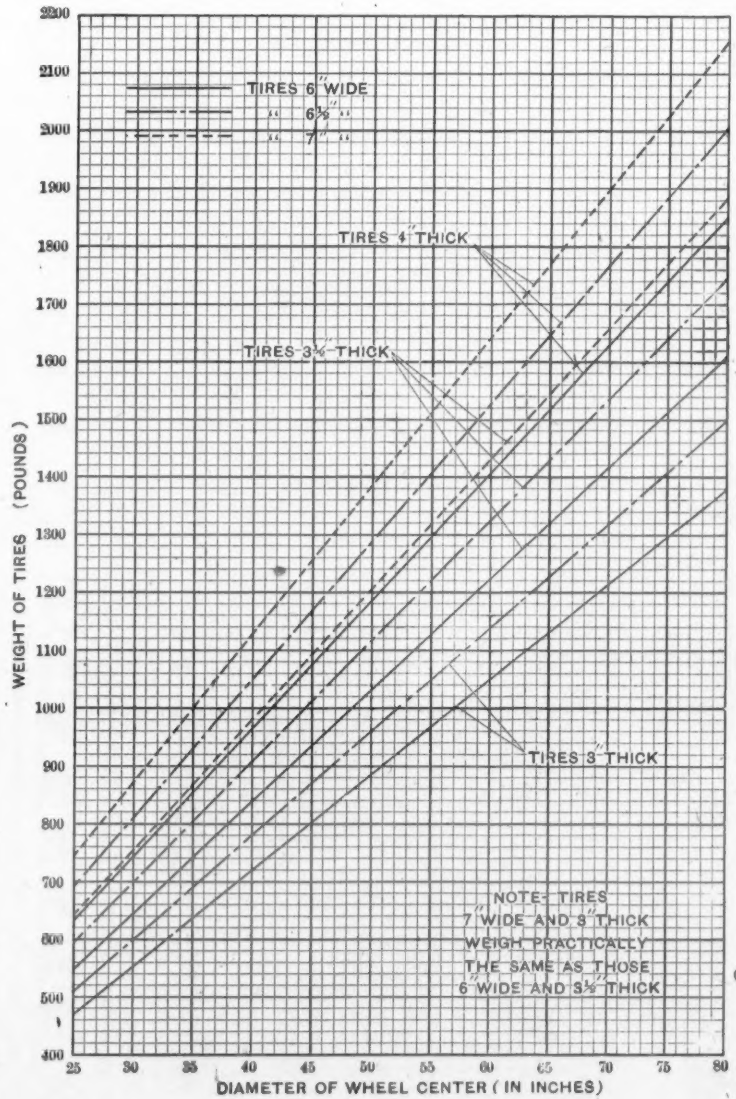
Consumption of India Rubber.—Rubber importations into the United States have grown from 10,000,000 lbs. in 1884 to 44,000,000 lbs. in 1904; the average value per lb. of the crude rubber has advanced in this time from 43 cents to 70 cents, and the total quantity imported in the crude state from 23,272,000 lbs. to 61,890,000 lbs. Doubtless the extension of electrical distribution has accounted for a large proportion of this increase.

Electricity on Steam Railroads.—In a paper read before the Western Railway Club Mr. Clement F. Street, commercial engineer of the Westinghouse Electric & Manufacturing Company, presented a very large amount of data covering the cost of operation of electric and steam railroads, including valuable tables, from which comparisons of costs may be drawn. This is a valuable addition to the literature on the subject, and as the paper cannot properly be presented in abstract, readers are advised to secure copies of the paper itself from Mr. J. W. Taylor, 658 The Rookery, Chicago, Ill.

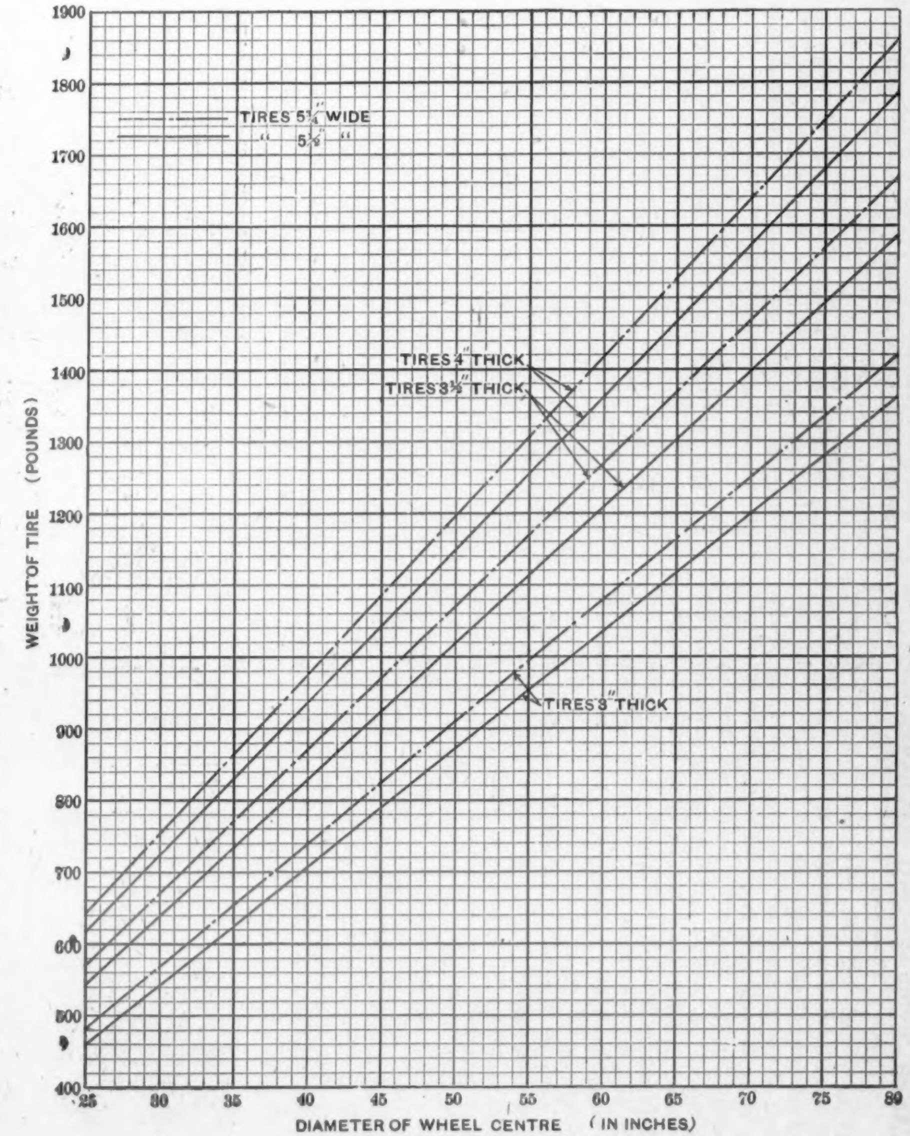
WEIGHTS OF DRIVING-WHEEL TIRES.

By means of the accompanying diagrams, it is possible to quickly find the weight of flanged and plain driving wheel tires of various widths and thicknesses for wheel centers from 25 to 80 ins. in diameter. For instance, to find the weight of a flanged tire 3 ins. thick and 5¾ ins. wide for a wheel center 53 ins. in diameter, it is only necessary to follow the vertical from the point 53 on the base of the diagram for flanged tires until it intersects the dot and dash line marked "Tires 3 ins. thick," and the horizontal from this point of intersection indicates that the tire weighs 960 lbs.

To find the weight of a plain tire 4 ins. thick and 6 ins. wide for a 57-in. wheel center follow the vertical from the point 57 at the base of the diagram for plain tires until it intersects the full line marked "Tires 4 ins. thick." The horizontal through this point of intersection indicates that the weight is 1,340 lbs.



WEIGHT OF PLAIN DRIVING WHEEL TIRES.



WEIGHT OF FLANGED DRIVING WHEEL TIRES.

PLANER TYPE MILLING MACHINES.

It is surprising to find that this type of machine is not more generally used in railroad shops when the advantages gained from its use in manufacturing establishments are considered. In one or two railroad shops machines of this type were found to be lying idle for a considerable portion of the time, but an investigation showed that they had been built a number of years ago, and both the strength of the machine and the driving power provided were entirely inadequate for using the high-speed cutters. It was almost pitiful to watch the slow feeds which it was necessary to use in order to keep within the limits of the machine, and it is no wonder that they were unable to compete with the more modern tools of other types.

Modern machines of this type are designed to rigidly support the cutters, and with plenty of power for operating the feed and the cutter so that the rate of doing the work depends on the strength of the cutter rather than on the machine. A large amount of work usually done on planers and shapers may be handled to advantage on such a machine, and this is especially true for irregular shapes if there is a sufficient number of each kind to be machined to warrant making special gang cutters with which several surfaces may be quickly and accurately machined at the same time.

It is important that the cutters be properly made and cared for. Too slow a feed will often injure them, as it is necessary for the teeth to cut into the surface, and not skim or rub over it.

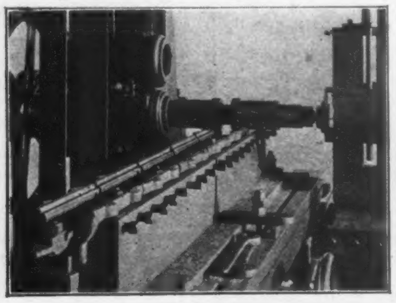


FIG. 1.

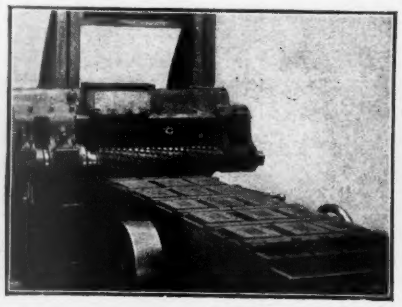


FIG. 2.

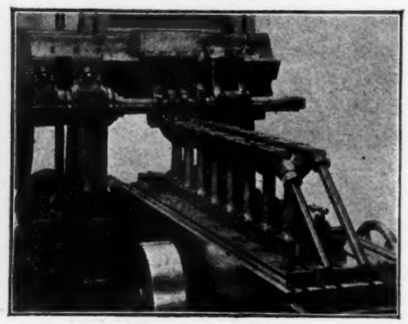


FIG. 3.

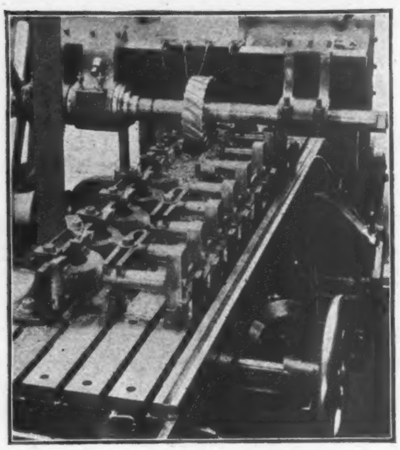


FIG. 4.

EXAMPLES OF WORK DONE ON SLAB MILLING MACHINES.

It must be kept in mind that what may seem like a heavy feed will prove very small if resolved to the thickness of cut per tooth and compared to that taken by a lathe or planer tool.

While the acompanying illustrations are not of work actually handled in railroad shops, yet it is very similar in many respects, and serves to give some idea of the rate at which the metal may be removed, and of the large saving in time where it is possible to use gang cutters on irregular surfaces. Fig. 1 shows five cast iron journal boxes being milled on an 84-in. Becker-Brainard planer type miller. The gang cutter finishes six surfaces at one time, feed 4 ins. per minute, cut 5-16 in. deep and 6 ins. wide; cutting speed of largest cutter, 40 ft. per minute. Ten minutes were required to set the boxes on the machine and 20 minutes to machine them. A very smooth finish was required, or the operation could have been done in less time.

Fig. 2 shows a number of cast iron steam chest covers being milled on a No. 32 Becker-Brainard miller. The peripheral speed of the cutter is 40 ft. per minute, the rate of feed 4 ins. per minute, the size of cut ⅛ in. deep and 20 ins. wide. Fig. 3 shows the first operation of milling several steel connecting rods on a Becker-Brainard miller. Four surfaces are being milled at the same time. The peripheral speed of the largest cutter is 24 ft. per minute, and the feed is 1½ ins. per minute. The second operation on these rods is shown in Fig. 4. A 10-in. cutter, 4 ins. wide, is taking a cut its full width and 1 in. deep, and at the same time is taking a 2-in. side cut. The cutting speed is 24 ins. per minute and the feed one in. per minute.

THE INTERNATIONAL RAILWAY CONGRESS.

The Congress to be held in Washington, D. C., May 3d-14th, has arranged its program as follows: Wednesday, May 3d, from 11 a. m. to 2 p. m., registration of members at the office of the general secretary, New Willard Hotel. May 4th, 11 a. m., formal opening of the session in the banquet hall of the New Willard Hotel. Election of officers.

The sections are to meet as follows: First section, at the Ebbitt House; second section, at the New Willard Hotel, north end; third section, at the New Willard Hotel, south end; fourth section, Raleigh Hotel; fifth section, rooms of the Interstate Congress Commission, F street. Meetings of the sections will be held at 9:30 a. m. and 2 p. m., May 5th, 6th, 8th, 9th and 10th. At 9:30 a. m., May 11th, 12th and 13th, additional meetings of the sections will be held, and at 2 p. m. of these three days general meetings. The congress will formally close at the general meeting at 2 p. m., Saturday, May 13th.

Sunday, May 14th, the foreign delegates will depart on tours of inspection tendered to them. Special tours are arranged for New York City May 1st and Philadelphia May 2d.

A tentative program for Washington has been arranged as follows: May 3d, general view of Washington and visit to the Washington Monument in the morning. Elaborate opening ceremonies of the railway supplies exhibition are arranged for the afternoon of that day, and a midnight signal around the world will be sent that night. May 4th, excursion to Mount Vernon in the afternoon. May 5th, visit to the public buildings. May 6th, open. May 8th, visits to the departments of state, war, navy and the treasury. May 9th, new terminal of the Washington Terminal Company and the new Union Station. Banquet by the American Railway Association to the foreign delegates in the evening. May 10th, Navy Yard and gun foundry. May 11th, Smithsonian Institute and National Museum. May 12th, visit to the Pension Office. May 13th, visit to Arlington and Fort Meyer; an exhibition drill of the troops.

Two special tours will follow the closing of the convention. The short tour leaves Washington on the evening of May 14th; Altoona, May 15th; Pittsburg, May 16th; Cleveland, May 17th; Buffalo, May 18th and 19th; Schenectady, May 20th; Boston, May 21st and 22d, arriving at New York May 23d, after a trip of about 1,500 miles. The long tour leaves Washington on the evening of May 14th; Altoona, May 15th; Pittsburg, May 16th; Cincinnati, May 17th; St. Louis, May 18th; Chicago, May 20th, 21st and 22d; Buffalo, May 23d; Montreal, May 24th; Saratoga, May 25th; Schenectady, May 26th; arriving at New York on the evening of May 27th. The length of this trip is about 2,700 miles. Extensive programs have been arranged for all of the cities visited, and special trains will be provided for each tour.

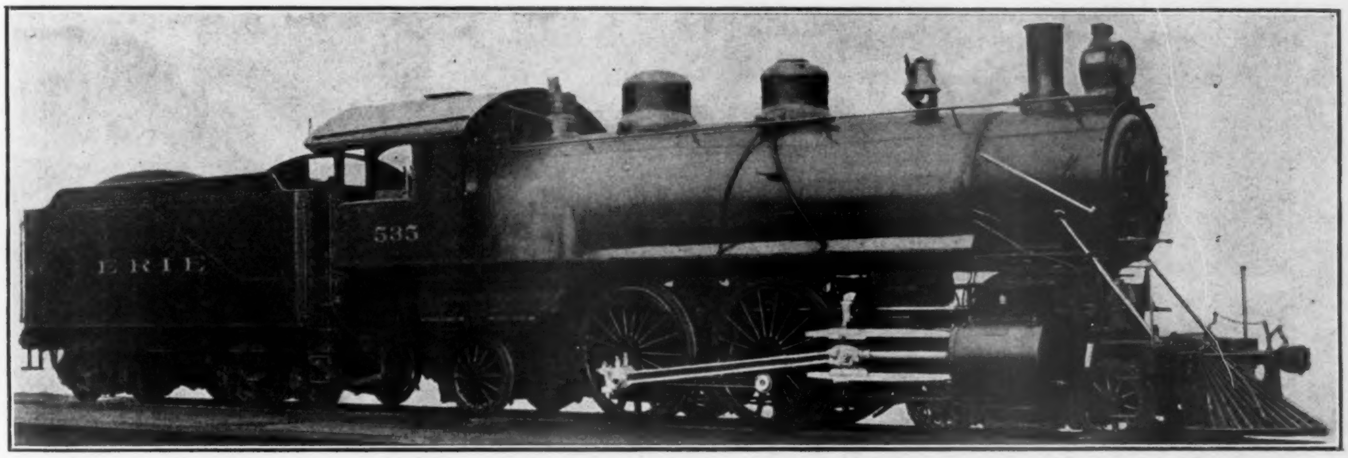
VAUCLAIN 4-CYLINDER BALANCED COMPOUND—ERIE RAILROAD.

4—4—2 ATLANTIC TYPE.

The Baldwin Locomotive Works have recently supplied two very powerful 4-cylinder balanced compound passenger locomotives for the Erie Railroad, the purpose being to handle 600-ton trains with fast schedules on a crooked, hilly road. Trains of this weight require more powerful locomotives than those previously in service on this road, and the Baldwin Works developed this design with 16 and 27 by 26-in. cylinders, with 115,500 lbs. on driving wheels, or 28,875 lbs. per wheel, and gave the boiler 3,657 sq. ft. of heating surface in order to meet these requirements. The tractive power is 28,000 lbs. This is the largest and most powerful locomotive of this type thus far constructed. The reports of service up to date are entirely satisfactory. The locomotive is illustrated by a photograph, which shows the tender of 8,500 gals. capacity. The leading dimensions of this engine are presented in the following table:

VAUCLAIN BALANCED COMPOUND—ERIE RAILROAD.
4—4—2 TYPE.

Gauge	4 ft. 8½ ins.
Cylinder	16 ins. and 27 ins. by 26 ins.
Valve	balanced piston
BOILER.	
Type	wagon top
Material	steel
Diameter	68 ins.
Thickness of sheets	11-16 in. and ¾ in.
Working pressure	225 lbs.
Fuel	soft coal
Staying	radial
FIRE BOX.	
Material	steel
Length	108⅛ ins.
Width	72 ins.
Depth, front	71½ ins.
Depth, back	69 ins.
Thickness of sheets, sides	⅜ in.
Thickness of sheets, back	⅜ in.
Thickness of sheets, crown	⅜ in.
Thickness of sheets, tube	½ in.
WATER SPACE.	
Front, sides and back	4 ins.
TUBES.	
Material	iron
Wire gauge	No. 12
Number	309
Diameter	2¼ ins.
Length	19 ft.
HEATING SURFACE.	
Fire box	186.2 sq. ft.
Tubes	3,422.8 sq. ft.
Firebrick tubes	28 sq. ft.
Total	3,657 sq. ft.
Grate area	54 sq. ft.
DRIVING WHEELS.	
Diameter, outside	72 ins.
Diameter, inside	66 ins.
Journals, front	10 ins. by 10½ ins.
Journals, back	9 ins. by 12 ins.
ENGINE TRUCK WHEELS.	
Front, diameter	33½ ins.
Journals	6 ins. by 12 ins.
TRAILING WHEELS.	
Diameter	44 ins.
Journals	8½ ins. by 12 ins.
WHEEL BASE.	
Driving	7 ft.
Rigid	16 ft.
Total engine	30 ft. 1 in.
Total engine and tender	59 ft. 10 ins.
WEIGHT.	
On driving wheels	115,500 lbs.
On truck, front	47,500 lbs.
On trailing wheels	41,200 lbs.
Total engine	204,200 lbs.
Total engine and tender	about 356,000 lbs.
TENDER.	
Wheels, number	8
Wheels, diameter	33½ ins.
Journals	5½ ins. by 10 ins.
Tank capacity	8,500 gallons water; 12 tons coal
Service	passenger



POWERFUL BALANCED COMPOUND LOCOMOTIVE—ERIE RAILROAD.

G. W. WILDIN, *Mechanical Superintendent.* BALDWIN LOCOMOTIVE WORKS, *Builders.*

AUTOMATIC COUPLERS.—A paper by Mr. A. W. Gibbs, general superintendent of motive power of the Pennsylvania Railroad, on this subject, to be presented at the approaching convention of the International Railway Congress at Washington, traces the development of automatic couplers in this country, illustrates the leading types and shows the influence of the safety appliance law on the application of these devices. Throughout the report references are given to articles and reports referring to couplers. This paper is an exceedingly complete and important document upon this subject.

EARLIEST RECORD OF SUPERHEATING.—Superheating is by no means a new thing. It was proposed by Joseph Hateley in 1768 (Specification of Patent No. 895 of 1768).—*R. Neilson, in Engineering Magazine.*

EVENING CLASSES, GRAND TRUNK RAILWAY.—The forty-seventh annual report of the Literary and Scientific Institute of the Grand Trunk Railway shows an average attendance in the mechanical drawing classes of 76, with other classes in proportion. The attendance of the evening classes during the season was 3,358. The classes for the study of locomotive models and air brake sections numbered 750. The total membership in the institute is 777. Members pay fees of one dollar per year and are entitled to privileges of the library and reading room, the use of models, and free admission to lectures and classes. It seems strange that such a good work as this could have been conducted for forty-seven years in Montreal without attracting more attention on this side of the border line.

ONE AND ONE-HALF MILLIONS OF DOLLARS IN PENSIONS.—The statistics of the Pennsylvania Railroad Pension Department, compiled, show that during the five years of its operation pension allowances have been paid to the retired employes of the company the sum of $1,614,087.59. The above expenditure does not include the expenses of operation of the department, which is also borne by the company. During the five years 2,418 employes have been retired as pensioners from active service, of which number 700 have died. Of the total number retired 568 were between the age of 65 and 69 years, of whom 439 were retired on their own request with the approval of the employing officer.

PRODUCTION IMPROVEMENTS.

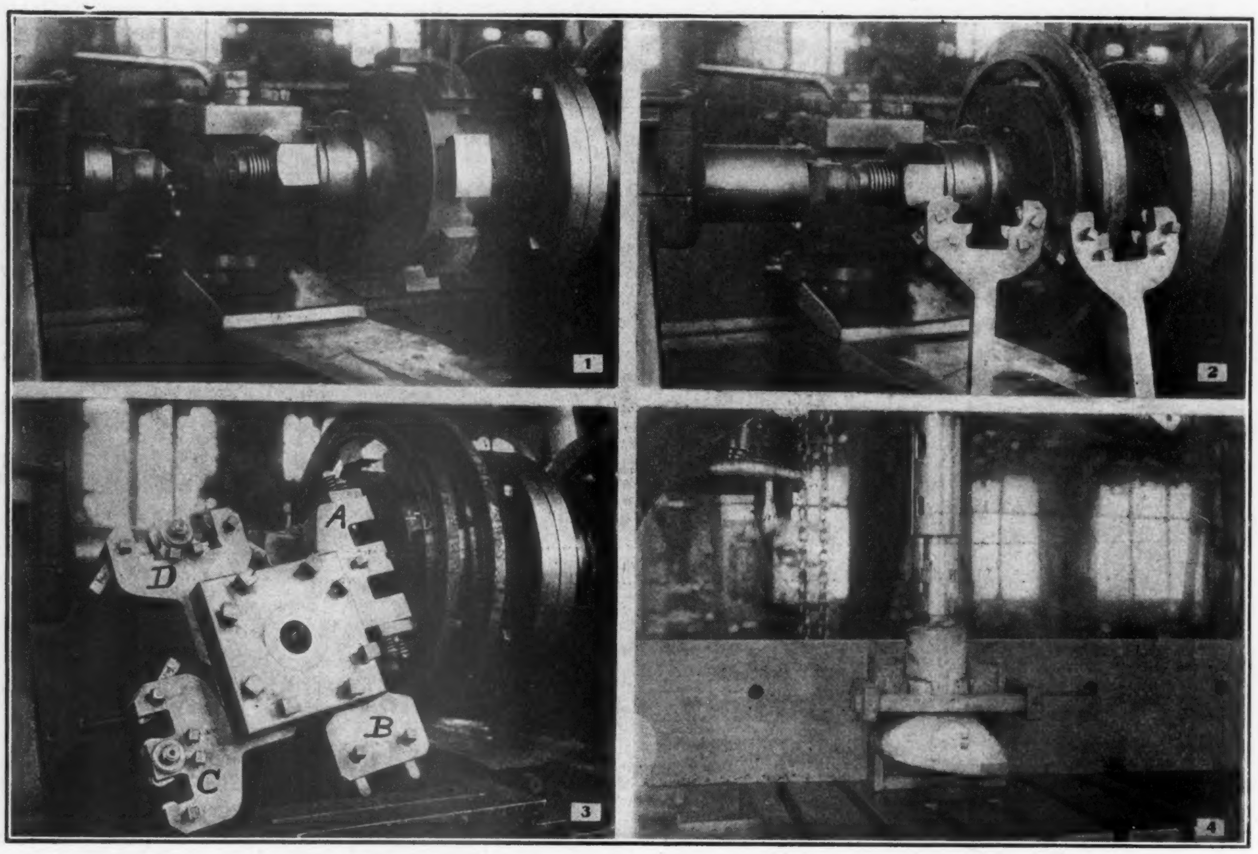
CHICAGO SHOPS—CHICAGO & NORTHWESTERN RAILWAY.

Fourteen bull rings, from 15 to 22 ins. in diameter, are completed in these shops in 8 hours on a stiff 28-in. Pond lathe, purchased about three years ago. Sixty-four piston packing rings, varying from 15¼ to 22 ins. in diameter, are finished on the same machine in 8 hours. This machine is used to supply bull and packing rings for the entire road, and is also available a large part of the time for other work.

To do this work an excellent expansible chuck and a four-sided turret for the tool post have been developed under the direction of Mr. Oscar Otto, general foreman. These are shown in the accompanying photographs.

The chuck itself is bolted to a flange carried on the lathe spindle. The body of the chuck carries segments, or shoes, which are adjustable radially by means of the cone shown at the left in the first photograph. Various sizes of the segmental pieces are provided for wide changes in diameters of the bull rings. The tail stock center is moved up against the spindle to illustrate the tools. At A are the centering rollers, used to center the packing rings before the cone of the chuck is tightened up for cutting. At B are the roughing tools for the outer surfaces of the rings. At C are the roughing tools for the sides of the rings, and at D are the tools for finishing both the sides and the cylinder wearing surfaces, the wearing surfaces being finished with slight grooves. The segmental pieces for holding two packing rings at once are in the form of equalizers, pivoted at the center in order to secure a satisfactory bearing on both rings at once.

For holding castings and parts of irregular shape for drilling and other processes, an ingenious device has been developed at these shops. The fourth photograph shows one of them, used to hold driver brake cams in the drill press. The device consists of a cast iron box, open at one end and at the top. To make the chuck, the piece is laid in the box in a horizontal position. The opening around the casting at the top is filled with putty, and melted lead is poured in until the box itself is full. When cool, the casting is removed, leaving a seat or socket which fits it with sufficient accuracy, and into



TURNING PACKING RINGS AND HOLDING ODD-SHAPED CASTINGS—CHICAGO & NORTHWESTERN RAILWAY.

to the spindle at the left of the chuck after the bull ring is in place, and then the cone is brought to bear on the segments by means of the large nut. This holds the bull ring firmly for a heavy cut, and when the work is done the large nut is slacked off. The segments are withdrawn from contact with the bull ring by small springs within the chuck, and the tail stock is moved back. Then the ring may be replaced by another. The first view shows the chuck when ready for a ring. The second shows a ring in place, and beside it are the roughing and finishing tools, removed from the turret in order to illustrate their construction.

In the third view the chuck for packing rings is illustrated. These rings are cast separately and turned in pairs, neither the bull rings or packing rings being finished inside. As the packing rings are limber, they are placed on the chuck over cast iron supporting rings, which are rendered flexible by a number of radial saw cuts shown in the third photograph. This view also shows the turret resting which the part may be quickly placed. For drilling driver brake cams four of these are placed against a long angle plate on the bed of a four-spindle drill made by Messrs. Foote, Burt & Co., similar to the one shown on page 423 of this journal in November, 1904. For convenience in photographing, the device is shown on an ordinary single spindle drill press. The chuck with the cam in place is clamped to the plate and the cam to the chuck, by a key which is quickly driven and as easily removed.

This method of holding pieces of irregular shape is typical of a number of applications used about these shops. It is ingenious, inexpensive and very efficient. It is used effectively, also, in connection with Gisholt lathes, and has wide possibilities of application in railroad shops.

A COMMENTARY ON AMERICAN TRAVELERS.—At the stations of the Santa Fe system last year $11,500 was received from chewing gum slot machines, not counting sales on trains.

PISTON VALVES BETWEEN FRAMES.

To the Editor:

On page 79 of your March number is illustrated what you called the "novel and interesting" location of piston valves of the new "Burlington" Prairie type locomotives. It does not detract from the interest of this arrangement to say that it is not novel. In your December number, 1899, page 387, you illustrated an exactly similar location of piston valves as applied by Mr. George R. Henderson to 2—8—0 locomotives of the Norfolk & Western Railway. Incidentally, Mr. Henderson should be credited with the direct valve motion arrangement of that consolidation engine, which was the predecessor of the present rather general use of that form of motion for piston valve engines. Mr. Henderson's idea in placing the piston valves between the bars of the frames is an excellent one, and it ought to have been more generally copied.

A. B. C.

WHAT CAN A FIREMAN SAVE.

To the Editor:

Referring to the article on page 53 of your February number under this heading and the comments of Mr. T. E. Adams on page 92 of the March number, I thoroughly agree with Mr. Adams. In recent years we have been so busily occupied in taking care of the larger engines that we have to a serious extent neglected the training of the men. Rigid discipline is now and always will be necessary to satisfactory operation, but the discipline must be built upon a proper method of educating the men. During the heavy business of the past few years we have been obliged to put firemen on freight engines after having only one week of training for this work. This is not enough, and I for one am glad to have my attention drawn to a point we have been overlooking. I have arranged to put into practice a system of promoting firemen from roundhouse men and arranging to take back into the roundhouse men who have been working as extra firemen, when they are not needed on the engines. In this way we can always have a supply of men who are familiar with locomotives and men who have had considerable experience about them. With our large engines we must give more attention to the education of the men as well as their selection, and instead of being an expensive luxury, education is becoming an absolute necessity. It has possibilities for improved service and improvement in economy which none of us realize. Better education of firemen is certainly one of the problems which we must seriously attack and we cannot get at it too quickly.

SUPERINTENDENT MOTIVE POWER.

WALSCHAERT VALVE GEAR.

To the Editor:

I have for a long time felt that Walschaert's valve gear possessed advantages which our railroads ought to appreciate, and it is with pleasure that I have read your recent articles on this subject.

One important point, however, you have missed. Those who had the privilege of watching various locomotives running on the St. Louis testing plant were impressed with the tremulous action of the Stephenson motion on big engines. Due to *weakness*, the motion springs and trembles all over, whereas Walschaert gear on the German and French engines ran with perfect smoothness. The reason is that the Stephenson link rocks through a wide angle, due to the influence of the back-up eccentric, and at the beginning and end of the stroke the inclined position of the link brings a great strain upon the lifter shaft and hangers. By watching a valve motion model through a complete revolution the reason is plain. The Walschaert link does not rotate as far and does not cause this strain. This fact alone is sufficiently important to bring the Walschaert motion into our practice.

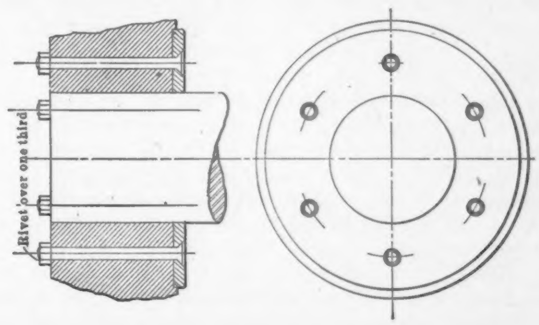
This motion is not new in this country. It was very successfuly applied years ago by the Mason Machine Works, the Taunton Locomotive Works and the Manchester Locomotive Works. If you desire, I can give you the names of the roads and the dates of application. These were almost all on narrow-gauge engines, where the outside gear was used because of confined limit of space inside. The same reason now applies to big standard-gauge locomotives, and, furthermore, the large eccentrics of to-day give too high a surface velocity to run cool. I believe that we must use the Walschaert gear in this country.

VALVE GEAR.

DEVICE FOR SECURING HUB LINERS.

To the Editor:

On page 103 of the March number of your valuable journal, I notice an article on driving wheel hub liners, and take the liberty of enclosing a blue print showing our method of applying these liners. We drill right through the hub, and put the liner on with 6 ⅝-in. turned bolts. On 8-wheel engines, where the distance from the outside face of the wheel hub to the inside of the side rods will permit, we put nuts on the bolts, but where the clearance will not permit of nuts being used we countersink the holes slightly on the outside of the hub, and rivet the bolts flush with the hub. We



find this a very solid fastening and very easily removed when repairs are made. In your illustration of the Boston & Maine method you show the countersunk head of the screw flush with the face of the hub liner. We have never been able to run copper or wrought iron screws flush with the face of the liner, as we find that they cut grooves into the face of the driving boxes. We always fit the head in ⅛ or 3-16 in. below the face of the liner to prevent cutting the faces of driving box.

J. J. CONOLLY, Supt. M. P. & M.,
Duluth, South Shore & Atlantic Railway.

THE COLLEGE MAN AND THE MOTIVE POWER DEPARTMENT.

To the Editor:

I have read with interest the editorials and communications which have appeared from time to time in your valuable journal concerning the special apprentice and the college man in the motive power department and believe that one of the most important phases of the question has been overlooked. After graduating from college I put in six years in the motive power department as shop apprentice, draftsman, chief draftsman and mechanical engineer and then had to leave the service because the salary received was not large enough to properly provide for the needs of my family. The experience gained during that time is, however, invaluable to me. After the first year and a half in the service I managed to make a living out of it, and that is all the average professional man can expect to do until after he is thirty years of age. If the men above me had been better paid they would not have left the service and I would not have had responsibilities thrust upon me that taxed my capacity to the uttermost and did much to make a man of me. What other field offers as wide an experience as does the motive power department? Briefly it includes problems in locomotive, car, roundhouse and shop design, construction, operation and maintenance, and as these bring one in touch with the other departments of the railroad, a few years spent in this work is a liberal education in itself.

I would strongly advise young college men to enter the mechanical departments of our railroads. Begin in the shop, don't be afraid of either work or dirt, keep your eyes open, take at least one good railroad technical paper and follow it closely, send in a short article or communication to it occasionally, join the nearest railroad club and attend its meetings whenever possible, and if you are familiar with the subject under discussion, say something, but remember that it is quality and not quantity that counts on such occasions. Get acquainted and let people know you are alive. If after a few years you are not satisfied with your prospects you will find that with the experience you have gained and the acquaintances you have made, a more lucrative position can be obtained with one of the many large concerns who manufacture and handle railway supplies and who require men who are familiar with railroad work. Those who are in a position to know claim that it is only a question of a short time when the railroads will fully awake to the possibilities of the motive power department, and when that

time comes young men will not have to look elsewhere for good positions. In the meantime this department at least offers a wonderful field to the ambitious college man who is anxious to gain a broad mechanical experience in a short time.

M. N. O.

WATER SOFTENING.

To the Editor:

The writer has noted the comments of Mr. A. McGill in a letter to your paper in March, page 92, in which it is directly or indirectly claimed that the system of tests mentioned in the series of articles on water softening is too delicate and entirely beyond any one but an expert, that such tests are unnecessary, that badly fluctuating water should not be used, that the soap test is most inaccurate, and that "there are elegant and accurate modes of doing what it (the soap test) proposed to do."

It is difficult to see the connection between a watch and water treatment, but if the illustration must be used it suffices to say that all that is demanded of the workman is that he wind the watch. It is expressly stated in the general article that the attendant is not held responsible in any way for the quality of the treated water. He does not have to make any repairs or do any thinking about charges or changes in charges. By referring to page 37 in the March number, it will be noted that the writer admits that the system of control *may appear at first glance* to be "intricate, difficult to follow and costly in operation." But the reverse of this is the case. Its workings have been smooth and accurate and undoubtedly excellent results have been obtained. The system is all but automatic in its operation. Mr. McGill has entirely missed one vital point, and that is that the scheme of analysis and control objected to is not a proposed one, but is one which in part has been in service for a year and a half and in full in its present shape for nine months. The tests are being made every day with great precision and success by common labor; some of the men can do little more than read and write, and not one has any theoretical knowledge whatever of chemistry. The tests are so simple that a child could make them and make them so accurately after a short experience that it would be hard for an expert chemist to surpass them. The time taken for a complete set of tests is from 10 to 25 minutes once or twice a day, and the danger of confusing tests or chemicals is entirely negligible. It may be repeated that these tests are not theory but practice, they have been working absolutely satisfactorily for nine months, despite the fact that during that time there have been at some of the softeners six or seven different attendants. In the light of such facts, the statements that these tests are beyond the ordinary workman are entirely incorrect.

It is impossible to satisfactorily treat river waters in a commercially active hilly country, such as is the neighborhood of Pittsburgh, without tests at the point of treatment. The waters in the rivers are continually changing, every rain effects them and every dry spell, not to speak of the pollution, which fluctuates but is always present. It is possible to treat stationary well water without local testing, but even there results could be improved if local tests were made. Mr. McGill states: "It may be well to send daily samples to some central laboratory in order that we may be sure that everything is going properly." That is taken care of in the scheme outlined in the general article; but how can results be satisfactory if proper charges are not made, and how can proper charges be made if proper tests are not made and made in time to effect the treatment? To show the variation, the following list of consecutive charges of soda during the last three weeks of December, 1904, at Buena Vista, is given, every charge treated the same amount of water: 247, 276, 331, 325, 312, 305, 299, 397, 324, 294, 300, 258, 258, 366, 366, 354, 348, 242, 210, 210, 30, 39, 36, 45, 45, 39, 39, 54 pounds. Surely it is not claimed that such waters could be treated by long distance testing.

On railroads water is required at certain fixed points and consequently the best available supply at the point must be used. The Pittsburgh & Lake Erie Railroad Company have spent large sums of money in investigating the available sources of water supply and have considered wells, long pipe lines, river water, etc., and have, it is needless to say, decided on what is, in their opinion, the right water, which of course, is very largely a matter of dollars and cents, not the initial but the ultimate cost. If a good water is available it should by all means be used, but if no good water is available, then the best of the bad ones, no matter how fluctuating, must of necessity be made to answer. The next step is the installation of a good softener and a proper system of local testing.

The much beligned soap test; the writer admits that he approached this subject two years ago with some of the general prejudice against it. He was fully aware of the adverse opinion of most of the men referred to by Mr. McGill, and it was only after exhaustive tests, both on the soap and other schemes, that the others were rejected and the soap test adhered to. As mentioned in the regular article, every means is taken to keep conditions uniform, every equipment, even to the bottles, is identical, chemical solutions are almost automatically kept standardized and every man makes his tests in identically the same way. Attention is directed to the comments on the soap test which appeared on page 138 of the April number; the data there given speak for themselves, the number of samples is large enough to show that the agreement is not accidental. Again, the argument of actual use may be used, the soap test along with the other two has given, under trying conditions, most satisfactory results, and consequently the error cannot be great. It is of course a somewhat startling assertion to make, in the face of such authorities quoted by Mr. McGill, that the soap test is reliable, but such a claim is here made in so far as it relates to use in water softening, at least on waters in the vicinity of Pittsburgh. This explanation for the supposed inaccuracy of the soap test is advanced, that the reason the result by soap test disagrees with that by full analysis is that the full analyses have heretofore incorrectly stated the conditions existing in the water, the apportionment of calcium, magnesium, etc., to carbonates, sulphates, chlorides, etc., being on an incorrect basis. The writer has no hesitation in claiming that, if a certain sample of any natural water of this vicinity, except perhaps an acid one, was independently tested for hardness by the soap test by the 10 water softener attendants on the Pittsburgh & Lake Erie Railroad, who are just ordinary untrained men or boys, the results would be the same to within one part per 100,000, and that not one of them would vary by as much as two parts per 100,000 from the hardness obtained from the complete analysis as made by the Pittsburgh Testing Laboratory, and also that if this water were above 25 or 30 deg. of hardness it would be impossible to get results as close from any 10 laboratories in the country, or even half that number. If, then, laboratories disagree, why should not a test which gives uniformly consistent results be used. The disagreement among chemists on water analysis is proverbial. Disagreements could be listed without number, those below are simply taken as a sample, they are from a paper read before the Engineers' Society of Western Pennsylvania, December, 1903, by Mr. J. O. Handy (the initials P. T. L. stand for Pittsburgh Testing Laboratory):

Parts per 100,000.

	Bloomington.		Joliet.	
	P. T. L.	H-t.	P. T. L.	H-t.
Carbonate of lime	29.15	3.66	28.29	3.30
Carbonate of magnesia	3.47	16.32	3.44	24.96
Sulphate of lime	1.65	19.75	7.58	42.70
Sulphate of magnesia	16.36	....	34.71	....
Sulphate of soda	....	....	1.12	....
Chloride of soda	3.14	2.93	14.85	13.99
Carbonate of soda	1.97	5.60	1.06	6.73

Substitute for the soap test. There is not a test for hardness published which anywhere approaches for simplicity the soap test or which could be made with precision by common labor, and therefore if it is admitted that tests at the plants are necessary then the soap test cannot be superseded. The test which has been received with the greatest favor is known by the name of the "soda reagent" test, and some able papers have been read by Mr. McGill before the Society of Chemical Industry, Canadian Section, published in their journal for April 15 and May 31, 1904, and an elaborate system of treating based thereon, read before the American Railway Engineers & Maintenance of Way Association, published in bulletin No. 55, September, 1904. As this is the system which Mr. McGill so strongly advocates elsewhere, it is perhaps fair to assume that it is one of those to which he refers as "an elegant and accurate mode . . ." A perusal of these papers referred to will but accentuate the simplicity and relative accuracy of the system in use on the Pittsburgh & Lake Erie Railroad.

The accuracy of the soda reagent method may be judged from the following extract from Mr. McGill's papers referred to, Journal, May 31. (The unit used by Mr. McGill is parts of lime, CaO, per million, the standard used on the Pittsburgh & Lake Erie and used throughout the series of articles on water softening is parts of calcium carbonate, $CaCO_3$, per 100,000, each one unit of the latter is equal to 5.6 units used by Mr. McGill.) "The precipitation of lime and magnesia in these operations is so close that the filtrates give but very faint reactions for these bases when tested, under most rigorous conditions, by oxalate and phosphate,

provided that the filtrates in question are perfectly clear. Nevertheless an experience, based upon many hundreds of tests, convinces me that an error which may amount to 50 parts per million (i. e., 8.93 units P. & L. E.) invariably occurs in this method of assay. The whole of the sources of this constantly occurring error are not known, but the following list comprises the most important:—" and then follow the five errors referred to, any one of which, except the first, is enough to condemn the method. There is also a proposed arbitrary addition of 25 parts per million (4.46 P. & L. E. units) to take care of three of the errors, the fifth error, turbidity of the filtrate, is varying and uncertain. Then follows a table showing the relation between the hardness as obtained by full analysis and that obtained by the soda reagent, the first 19 items of which table are reproduced below, with the addition of the last column at the right hand side to reduce the error to the same units as are used in the article on water softening in this journal.

Parts per 1,000,000, Calcium Oxide.

Serial No.	Name.	By Ordinary Quantitative Analysis. CaO	MgOx. 1.4	Sum.	Hardness as CaO by Soda Reagent.	Error.	Error. (P.&L.E. Standard)†
1	Portage	184	176	360	347	13	2.32
2	Calgary	121	160	281	286	* 5	*0.89
3	Regina	219	211	430	414	16	2.85
4	Farm Dam	349	376	725	711	14	2.50
5	Plum Coulee	359	276	535	521	14	2.50
6	Maniton	63	42	105	95	10	1.78
7	Mooris	270	197	467	403	64	12.50
8	Snowflake	494	232	726	689	37	6.60
9	Kincorth	129	102	231	196	35	6.25
10	Lenore	184	141	325	319	6	1.07
11	Binscarth	239	104	343	347	* 4	*0.71
12	Moosomin	298	160	458	437	21	3.75
13	Lillis	234	127	361	330	31	5.54
14	Gretna	354	270	624	622	2	0.35
15	Suffield	106	78	184	151	33	5.89
16	Virden	246	136	382	308	74	13.21
17	La Riviere	121	64	185	179	6	1.07
18	Gull Lake	264	224	488	442	46	8.21
19	Broadview	170	113	283	252	31	5.53

*Excess; all other figures, defect.
†Parts per 100,000 calcium carbonate.

The discrepancy is most marked, only three out of the 19 came within one part per 100,000 of being correct. The variation is from an excess of 0.89 to a defect of 13.21, P. & L. E. standard, and yet this method is claimed to be superior to the soap test. A glance at the first 19 items in the article on page 138 will show the validity of the claim. It is only fair to add that the waters tested just above are, as a rule, harder than those tested on the Pittsburgh & Lake Erie.

With the soda reagent system of testing, the determination of hardness of treated water is absolutely impossible, for of what use is a test for water of about a total hardness of 6 when the admitted average error is in the neighborhood of 5? The soda reagent test for hardness is of course supposed to be used for approximate analysis only; that is also the claim advanced for the soap test. The soap test is not put forward as a scientific analysis of water, but it is claimed that it will give consistent and accurate information concerning the total hardness of water; certainly far within the limit of error granted by Mr. McGill in his concluding paragraphs; a laboratory that will not work far below 10 grains per imperial gallon, 14.3 parts per 100,000, is not worthy of serious consideration, a water softener attendant who would not work to below 30 per cent. of this error would not be retained in the employ of this company; the majority of them can and do work below 10 per cent. of it.

The system of tests and control used on the Pittsburgh & Lake Erie Railroad needs no apology, the results speak for themselves. That they are satisfactory from a chemical standpoint is beyond question. Every facility will gladly be accorded anyone who desires to make a personal investigation.

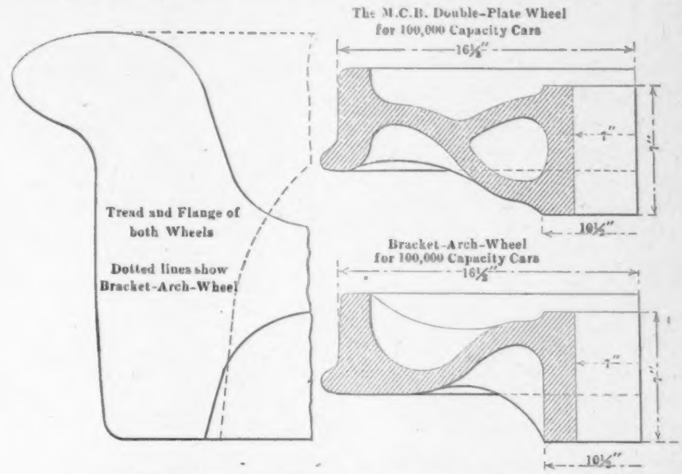
G. M. CAMPBELL.

"BRACKET-ARCH" CAST-IRON CAR WHEEL.

To the Editor:

In this type of wheel there is no double plate nor ring core around the hub. This allows the wheel to be thoroughly inspected and makes it absolutely safe, as any defect can be readily detected. The large amount of grey metal over the flange because the arch plate ends over it, adds additional strength and absorbs and conducts the heat from the flange caused by braking and by friction of the flange against the rail. The arch plate and heavy fillet over the flange prevents the development of seams in the throat of the flange so often met with in the double plate wheels in general use under the modern heavy cars. As the "bracket-arch" wheel takes but half the time required by the double plate wheel, it has better chill, the metal is more regular in grain and the wheel is much stronger. According to the M. C. B. drop and thermal tests this wheel is from 25 to 30 per cent. stronger than the double plate wheel of the same weight and of the same iron. Seven hundred pound wheels of this type are in service under 100,000 lbs. capacity cars on two of the principal roads in the country. This type of wheel is in service on three of the best known railroads in this country.

Single plate wheels were made 50 years ago by Messrs. Whitney & Son, Philadelphia, and were used on different roads at that time. Hart and Washburn patented a single plate wheel April 3, 1849. But I have no information that any of the type had ever been in service. The single plate wheels that have been patented and those that have been in service previous to the "bracket arch" wheel are very different in construction in several important parts. The "bracket arch" wheel is designed to meet the requirements of the modern 50-ton freight cars and increased speed of trains.



"BRACKET ARCH" CAST-IRON CAR WHEEL.

D. P. RENNIE.

Louisville, Ky.

PECULIAR TIRE WEAR.—On the Boston Elevated the tires for motor cars wear polygonal, and require grinding once or twice a month. The spots at first are short, then two or more unite, until there are only 16 or 20 for the entire circumference. Between the flattened spots a portion of the metal hardens by the action of the brake shoes, and does not reduce as fast as the other parts of the tread. The microscope shows a series of transverse cracks, indicating a tensile strain on the surface of the metal, exceeding the elastic limit. Between the high portions the treads are scored by a series of irregular diagonal lines across the tread. The rail heads on curves were abraded by forcing the wheel treads diagonally across the top of the rail. The rails of 0.45 to 0.50 carbon, on curves of 90 to 110 ft. radius, were reduced ½ in. in height from 90 to 120 deg. Rails of higher carbon have since been introduced, which wear from four to five times as long.—*P. H. Dudley before Int. Ry. Congress.*

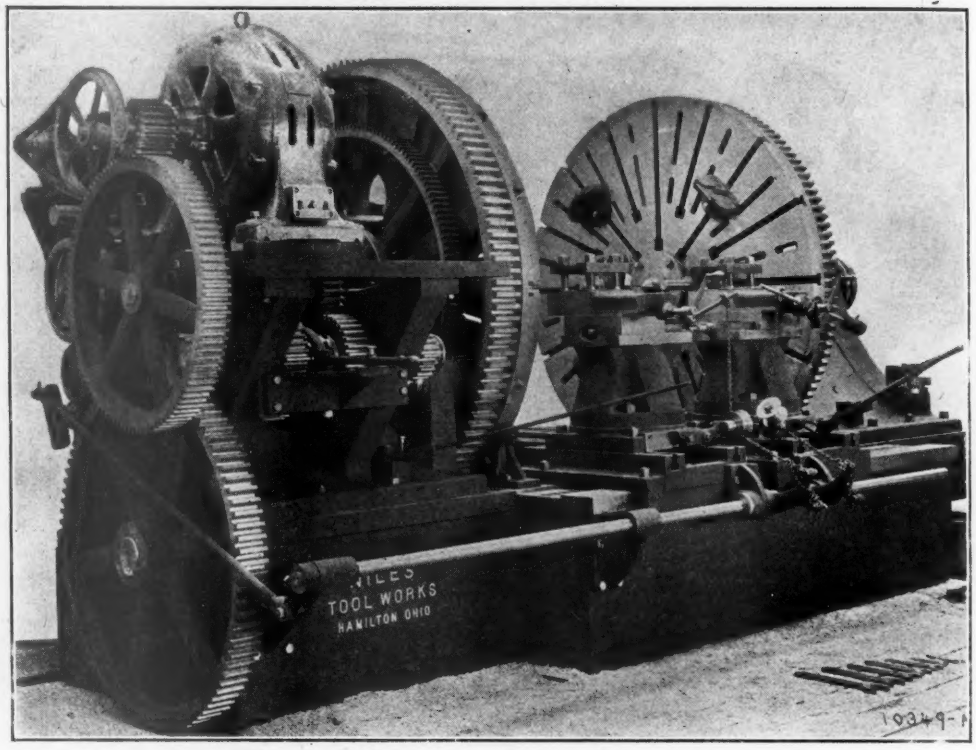
HOME MADE SCRAP STRAIGHTENING HAMMER.—For straightening scrap iron Mr. W. J. Shea, master mechanic of the Illinois Central Railroad at McComb City, Miss., has arranged an 8-in. air brake cylinder on an upright post for use in straightening scrap bar iron at that shop. This simple device is very convenient. It consists of an anvil and post, an old brake cylinder, a valve for operating the cylinder, which is worked by a treadle, and the device is completed by an oil cup for lubricating the piston. By its use a great deal of the scrap material is straightened in the scrap yard by unskilled labor.

LABOR SAVING, BOILED DOWN.—The entire gas supply of Oakland, Cal., is made in a single oil gas generator set, having a capacity of 150,000 cu. ft. of gas per hour, requiring the labor of but one man. Oil is used for fuel as well as for the manufacture of the gas, and no coal whatever is handled at the plant.

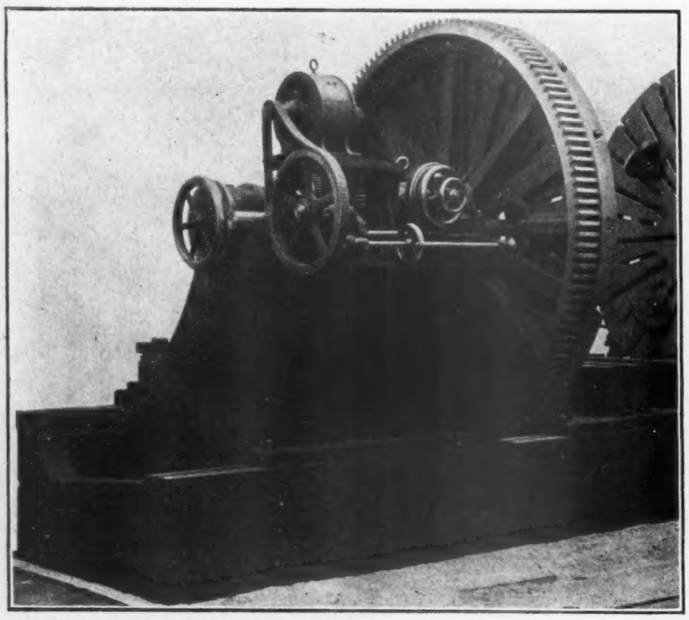
90-INCH DRIVING WHEEL LATHE.

The Pere Marquette Railroad has just installed a Niles new standard 90-in. driving wheel lathe in their shops which is designed to take two cuts ½ in. deep with a 3-32-in. feed, at a cutting speed of 20 ft. per minute, thus removing about 350 lbs. of metal per hour. It has a capacity between face plates of from 6½ to 9 ft. and swings 91 ins. over the bed. The speeds are arranged for turning wheels from 50 to 84 ins. in diameter, and the wheels are taken in or out of the machine without changing the position of the carriages, it being only necessary to move the tailstock sufficiently to the rear to withdraw the crank pins from the openings in the face plates. One man can easily move the tailstock by means of the ratchet and lever, but if desired a 3-h.p. motor may be furnished for this purpose. A 30-h.p. General Electric motor with a speed range of from 400 to 800 r.p.m. is used for the main drive. The quartering attachments are each driven through Morse silent chain by a 3½-h.p. motor with a speed range of from 980 to 1,275 r.p.m.

Each face plate is equipped with four of the new patented chuck driver dogs. These drive through "sure-grip" tool steel jaws engaging at the outer rim of the tread and entirely eliminate all chatter. The arrangement of these driver dogs, together with the ready means of moving the tailstock, and the clear space in front of the carriages (back of the bed) make it possible to largely reduce the time necessary in changing from finished to new work. The driver dogs are attached to the face plates and therefore it is only necessary that the bolts and clamps be moved. In many instances it has been found possible to drive without the use of the clamps and bolts. The tool rests are of a new design, arranged to reach forward to the minimum diameter of the work. The base is arranged to swivel as usual. The rocker shaft is arranged at the front of the bed and makes 4 vibrations to 1 revolution of the work, in this way dividing the feed of tool into the work, and making it more nearly a continuous feed. The feeds are 1-24 in. to ¼ in. per revolution of the work, each increase of one notch on the ratchet is equal to 1-24 in. If desired, the machine may be equipped with adjustable carriages, fitted to the bed at the rear, which support two separate journal turning tool rests.



NILES 90 INCH DRIVING WHEEL LATHE—PERE MARQUETTE RAILROAD.



REAR VIEW OF DRIVING WHEEL LATHE, SHOWING QUARTERING ATTACHMENT.

CHANGES IN DRILLING MACHINE DESIGN.

Less than two years ago a certain railroad changed several upright drills, which were giving satisfactory results using carbon steel drills, from belt to motor drives. At that time high-speed drills were in an experimental stage, and in order to provide for using them, in event of their proving satisfactory, the motors selected were at least 50 per cent. larger than required with the use of carbon steel drills, the spindle speeds were increased considerably, and the motor brackets were made of very heavy design, thus affording a strong back brace for the column and stiffening it against vibration. As the high-speed drills came into use it was found that the heavier feeds could not be used to advantage because of the slipping of the feed belts, thus emphasizing the need of a more powerful feed and suggesting the use of a positive feed mechanism. The higher spindle speeds were found to be too low, and the lower ones were seldom used, if at all. In spite of the heavy bracing, there was considerable vibration when the high speeds and coarser feeds were used, and, although these machines were probably as strong as any other standard machine of their size, it was found necessary to humor them considerably on the heavier work.

To overcome defects of this kind, machine tool builders have had to make some radical changes in their standard designs. Columns are being made larger, and in some cases are being strengthened by substantial back braces; coarser feeds and higher spindle speeds and more of them are being provided. In one of the most recent designs the swinging table is done away with, and a compound table very similar to that on an ordinary shaper is used. It is thus possible to support it very rigidly and to make the column of a heavy box form. Another recent design has six positive feeds, ranging from .006 to .039 in. per revolution of the spindle, and change from one feed to another may be made instantly. The heavier duty, caused by the use of the new steels, wore the journals on the

old machines quite rapidly, and it has been found necessary to provide larger ones, to use longer bearings and to strengthen the gearing.

Some of the recent motor applications to upright drills are open to considerable criticism; as a rule, the motor applications to these machines are not as good as those to other classes of machine tools. Possibly the purchaser is to some extent responsible for this condition. The sizes and ranges of speed of different makes of motors of the same capacity vary so much that the special brackets are a considerable item of expense to the builder, and as the nature of the machine is such that belts can be used, it is cheaper to thus connect the motor to the driving shaft. We even find that in some cases two belts are used in order to make use of tight and loose pulleys. While the first cost of a machine driven in this way may be less, the cost of the maintenance of the belts and the loss of power by this means of transmission will in time offset this saving. There is no reason why the motor cannot be mounted on a substantial bracket and be connected to the driving shaft, either by spur gears or a silent chain, thus making a positive drive.

If high-speed drills have shown up defects in the design of upright drills, they have made even greater trouble for the builders of radial drills. The coarser feeds have greatly increased the upward thrust on the arm, and this and the increased twisting action, due to the saddle being on one side, have made it necessary to very greatly increase the strength of the entire machine. It is an interesting study to see how the various builders are strengthening the parts without increasing the weight of the machine to such an extent as to make it unwieldy. The columns are being made much stronger and more rigid. The arms are being designed as cantilever beams of uniform strength, with the metal distributed to the best possible advantage, thus greatly strengthening them, and in many cases considerably improving their appearance from an engineering standpoint. As a rule, positive feeds are provided, and the motor applications are much better than those to upright drills.

MALLET COMPOUND LOCOMOTIVES, AMERICAN RAILROAD, PORTO RICO.

Four of these locomotives, by the Baldwin Locomotive Works, have gone into service under particularly trying conditions. The road is crooked, the gauge 3 ft. 3⅜ ins., and the steepest grade is about 2 per cent., and the trains are of about 500 tons each. Compounds were desired because of the high cost of fuel, and the character of the track construction would not permit of highly concentrated loads. These conditions required the Mallet type, yet the decision to use it was accompanied with misgivings, because only native, and not the highest grade of labor is available for either their operation or maintenance.

The low-pressure cylinders with the three leading axles form a truck which is pivoted, by a substantial hinged joint, to the saddle casting of the high-pressure cylinders. The front end of the boiler is carried on two segmental slides, one of which is shown in the photograph.

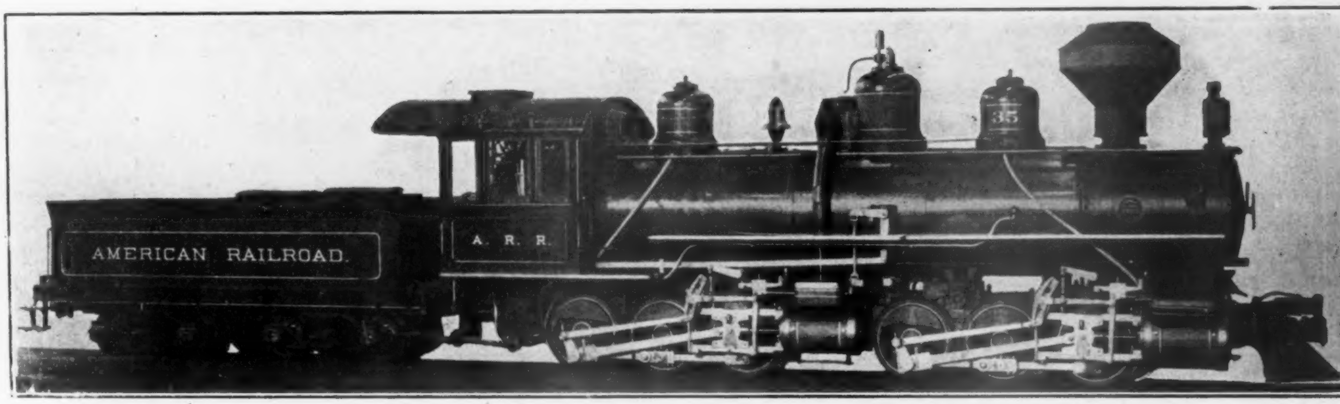
Of necessity, the Walschaert valve gear was used on these engines, and this is important in estimating the value of the Walschaert gear for standard-gauge locomotives. In this case inside gear could not possibly be used because of insufficient room. In standard-gauge locomotives there is sufficient room for the gear itself, but not sufficient space for its proper care.

These little engines are giving excellent results, as shown in reports of service, showing great economy of fuel and greater hauling power than any engines previously used on the island. If Mallet compounds will operate satisfactorily in charge of Porto Rican negroes, why should we not obtain the advantages offered by this type of construction with our enlightened people and methods?

A list of dimensions follows:

MALLET COMPOUNDS FOR PORTO RICO.

Gauge	3 ft. 3⅜ ins.
Cylinder	12½ ins. and. 19 ins. by 20 ins.
Valves	balanced
Boiler.	
Type	straight
Diameter	54 ins.
Thickness of sheets	9-16 in.
Working pressure	200 lbs.
Fuel	soft coal
Staying	radial
Fire Box.	
Material	steel
Length	95 15-16 ins.
Width	27¼ ins.
Depth, front	51 ins.
Depth, back	49 ins.
Water Space.	
Front	3½ ins.
Sides	2½ ins.
Back	2½ ins.
Tubes.	
Material	iron
Wire gauge	No. 12
Number	155
Diameter	2 ins.
Length	15 ft. 6 ins.
Heating Surface.	
Fire box	106 sq. ft.
Tubes	1,251 sq. ft.
Total	1,357 sq. ft.
Grate area	18 sq. ft.
Driving Wheels.	
Diameter of outside	37 ins.
Diameter of inside	32 ins.
Journals	6 ins. by 7 ins.
Wheel Base.	
Driving, each group	6 ft. 10 ins.
Rigid, each group	6 ft. 10 ins.
Total engine	20 ft. 4 ins.
Total engine and tender	42 ft. 8 ins.
Weight.	
On driving wheels	106,650 lbs.
Total engine	106,650 lbs.
Total engine and tender	about 156,000 lbs.
Tender.	
Wheels, number	8
Wheels, diameter	26 ins.
Journals	3¾ ins. by 7 ins.
Tank capacity	2,200 gals.



MALLET COMPOUND LOCOMOTIVE FOR PORTO RICO—BALDWIN LOCOMOTIVE WORKS, *Builders.*

PRIZE COMPETITION.—The *Engineering News* Publishing Company has instituted prizes of $250 and $100 for the best papers on the subject of the manufacture of concrete blocks and their use in building construction. Information may be obtained from *Engineering News*, 220 Broadway, New York.

BELTING.

The following notes are abstracted from a set of belting instructions compiled by Mr. F. M. Whyte, general mechanical engineer of the New York Central Lines, and issued for use in the shops by Mr. R. T. Shea. The time that machines are out of service due to belts being repaired or replaced is the largest item of expense in the cost of belting and its maintenance, and this is especially true if several machines must be stopped while one belt is being repaired. The most important consideration therefore in making up tables and rules for the use and care of belting is to secure a minimum of interruption to machine operation from this source.

It is desirable to locate the machinery so that the belts shall run off from each shaft in opposite directions, as this arrangement will relieve the bearings from the increased friction that would result were the belts all to pull the same way. Two shafts connected by a belt should never, if possible to avoid it, be placed one directly over the other, as in such a case the belt must be kept very tight to do the work. It is desirable that the angle of the belt with the floor should not exceed 45 deg. If possible the machinery should be so placed that the direction of the belt motion shall be from the top of the driving to the top of the driven pulley. The faces of pulleys should be about 25 per cent. wider than their belts. When practicable, belts should be tightened by moving one pulley away from the other.

The ability of a belt to transmit power depends upon the tension under which it is run, the degree of friction between the belt and the pulley, the complete contact of the belt with the pulley, the speed of the belt, and the arc of the pulley in contact with the belt. The tensile strength of single, ordinary tanned leather belting is about 4,000 lbs. per sq. in. The working strain should not exceed 10 per cent. of its tensile strength. The average leather belt will not transmit a force equal to its strength, for the reason that it will slip on its pulley before it will break.

As the friction of leather on leather is five times as great as that of leather on iron, the adhesion between the belt and the pulley can be greatly increased by covering the pulley with leather. The belt is thus capable of doing more work for a given width; the belt tension can be lessened to get the necessary friction, thus adding to the life of the belt; and unnecessary wear of the belt and a wasteful loss of power due to its slipping on the pulley are prevented. The strain to be allowed for all widths of belting—single, light double and heavy double—is in direct proportion to the thickness of the belt, firmness of the leather being the same in all cases. Avoid running belts too tight, as great tension shortens the life of the belt, occasions a waste of power and causes great inconvenience from hot boxes, broken pulleys and "sprung" shafting. Belts, like gears, have a pitch line, or a circumference of uniform motion. This circumference is within the thickness of the belt, and must be considered if pulleys vary greatly in diameter and a required speed be necessary.

Belts are more satisfactory made narrow and thick, rather than wide and thin. Thin belts should not be run at a high speed or wide belts be made thin. Such almost invariably run in waves on the slack side, or travel from side to side of the pulley, especially if the load changes suddenly. This waving and snapping wears the belts very fast; it is greatly obviated by the use of a suitable thickness in the belts. For new belts those that have already been filled with some good waterproof dressing are preferable to "dry" belts, for if not so filled they soon will be, with lubricating oil and water, a combination that will ruin any belt. Rubber belts should be used in places exposed to the weather, as they do not absorb moisture, nor so readily stretch or decay as leather belts under like circumstances. A new belt should be made straight, and if so made will run absolutely straight if the pulleys are in line. Slots punched in the center of a belt allow a chance for the air to escape between the belt and the pulley, and prevent "air cushion"; this is of a particular advantage in all belts running at high speed.

It is safe and advisable to use a double belt on a pulley 12 ins. in diameter, or larger. Light double belting runs steadily, with a minimum of "snap" or vibration, and does not twist out of place like single belting. It is successfully used for counter belts where shifters are used and where the work is not sufficiently hard to demand a heavy double belt; it is especially adapted for use on cone or flange pulleys, as it will keep its place and is less liable to turn over, and at the same time is pliable enough to hug the pulleys like a single belt. Double belting, light or heavy, is not recommended for twist belts at high speed, nor for wood work where belts are exposed to a large amount of chips or shavings, nor for places where much oil or water are liable to get on it.

As a means of making necessary alterations in the length of a belt the laced joint is recommended. To lace a belt, cut the ends perfectly true with the aid of a tri-square. Punch the holes exactly opposite each other in the two ends. The grain (hair) side of belt should be run next to the pulley, and the belt should run off, not on to the laps. For belts 1 in. to 2¼ ins. wide use ¼-in. lacing; 2½ ins. to 4½ ins. wide, use 5-16-in. lacing; 5 ins. to 12 ins. wide, use ⅜-in. lacing. For wider belts use wider lacing. Avoid thick lacing. In punching a belt for the lacing, it is desirable to use an oval punch, the longer diameter of the punch being parallel with the belt, so as to cut off as little of the leather as possible. There should be in each end of the belt two rows of holes staggered. Holes should be as small as possible. Recommended number of holes in the belt end for various widths are as follows:

Width in inches.........	2	2½	3	4	5	6	8	10	12
Number of holes........	3	4	5	7	9	11	15	19	23

The edge of any hole should not come nearer to side of the belt than ⅝ in., nor nearer the end than ⅞ in. The second row should be at least 1¾ ins. from the end of the belt. On wide belts these distances should be even a little greater. Begin to lace in the center of belt, and take much care to keep the ends exactly in line, and to lace both the sides with equal tightness. The lacing should not be crossed on the side of the belt that runs next to the pulley.

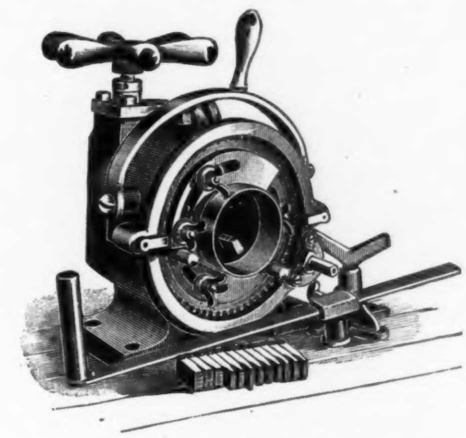
Belts and pulleys should be kept clean and free from accumulations of dust and grease, and particularly lubricating oils, some of which permanently injure the leather. They should be well protected against water, and even moisture, unless especially waterproofed. Resin should not be used to prevent belts from slipping. If a belt slips see first that the pulley is not dirty. Clean all the dirt from it and from the belt; rub the pulley surface of the belt with a dressing composed of 2 parts of tallow and 1 part of fish oil, rendered and allowed to cool before using. This will soften a belt and also preserve it, and it will not build up on the pulley and cause the belt to run to one side. If the belt then slips it is overloaded, and the remedy lies in a leather-covered pulley, a wider belt or a larger pulley.

PORTABLE PIPE CUTTING AND THREADING MACHINE.

A hand die stock with its long handles is not satisfactory where it is necessary to thread several pieces of pipe at a time or for threading the larger sizes of pipe; for instance, three or four men are required to thread a piece of 4-in. pipe. It is often desirable to have a portable machine which may be operated either by power or by hand, and with which one man can easily thread the larger sizes of pipe. The machine shown in the accompanying illustrations is intended for use where it will not pay to install an expensive power machine which will have to be permanently located at one point and have all the pipe brought to it. It is portable, but by the addition of a cast iron base and the necessary gearing and countershafting it may be operated by power. If equipped for power, it may readily be taken off its base and used on outside work as a hand machine. Fig. 2 shows one of these machines driven by a Crocker-Wheeler Company 2 L motor, which has a speed variation of 2 to 1 by means of field control.

The machine consists of a die-carrying gear supported and surrounded by a shell, and driven by a small pinion imbedded in the side of the shell. The pipe is placed in the vise at the rear of the machine, with the end to be threaded against the back of the dies. The die-carrying gear is then revolved by means of a crank on the end of the pinion shaft and is drawn into the shell against the end of the pipe. The dies open and are adjustable. When the thread is cut they can be opened and the pipe taken out without stopping the machine or running it back. In cutting off the pipe the large gear is shoved back in the shell, and is held by a stop, which allows it to rotate, but prevents longitudinal motion. A blade cutter is then inserted in the gear and is automatically fed against the work.

If it is necessary to cut a thread on the exposed end of the pipe, the machine can be slipped on the end and the thread



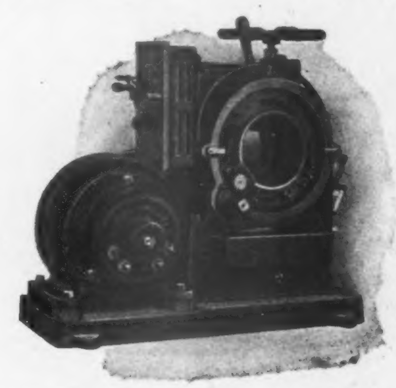
PORTABLE PIPE THREADER AND CUTTER.

cut without disconnecting it. Because of the large gear reduction, one man can easily cut a thread on any size of pipe which the machine will handle. The dies may be sharpened by grinding without drawing the temper. The shells are adjustable for wear. This machine is known as the Forbes' patent die stock, and is made by The Curtis & Curtis Company of Bridgeport, Conn., in sizes to thread pipe between ¼ and 14 ins. in diameter. Its small size permits it to be used in confined spaces.

PLANER PRACTICE.

That the manufacturers of planers have not been behind in improving their machines in accordance with the recent marked advance in machine shop practice is shown by the improvements which have been made during the past year or two. The aim has been to strengthen them to take the heavy cuts with the high-speed steels, to make the operation more convenient in order to save as much of the operator's time as possible, and to improve the driving mechanism and provide for higher cutting and return speeds, and in some cases a variable cutting speed with a constant return speed. Because of the reciprocating motion and the weight of the moving parts, more especially of those revolving at a high speed, the problem has been a difficult one. That it has been successfully solved is indicated by the fact that the tool steel maker can no longer boast that machines of this type cannot be made to work to the limit of the high-speed steels.

The return stroke of the planer is unproductive, and the ideal condition would, of course, be to eliminate it entirely in point of time. The return speeds recommended by the different makers vary from 60 ft. per minute for the larger size machines to 200 ft. per minute for the smaller ones. There is, however, a considerable difference of opinion as to the maximum return speed which it is advisable to use. Several makers do not recommend higher speeds than 100 ft. per minute, because of the shock, and the large amount of power consumed at reversal, but state that they are prepared to provide higher speeds if desired. At least two makers, however, flatly recommend using a return speed of 200 ft. per minute under certain conditions, and claim that their machines may be successfully and economically operated thus. One of these recommends 200 ft. per minute for 24-inch planers and 80 ft. per minute for 120-inch machines, the speed varying proportionately for intermediate sizes. The other recommends a return speed of 200 ft. per minute when the cutting speed does not exceed 65 ft. per minute, and 150 ft. per minute with higher cutting speeds, and claims that this is entirely practical, and can be done without shock or jar at the reversal. This machine is so arranged that a high or low return speed may be obtained by simply raising or lowering a latch. This is the only planer which provides for a variation in the speed of the return stroke independently of the speed of the cutting stroke if we except those driven by the reversible motor drive described on page 31 of our January journal, which may be arranged to provide a variable return speed entirely independent of the cutting speed. The advisability of providing



MOTOR DRIVEN PIPE THREADER AND CUTTER.

for more than one rate of return speed except in a case such as cited above is very questionable.

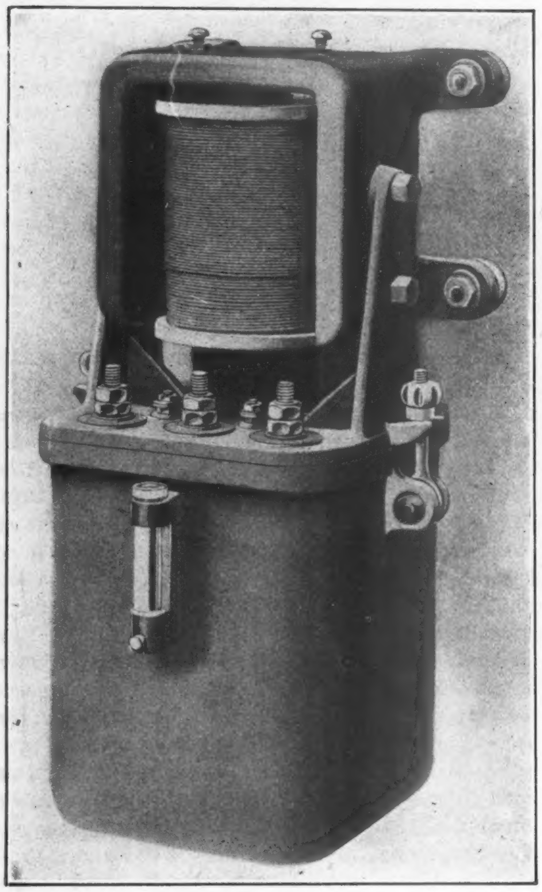
The cutting speed depends on the tool steel, the material and the nature of the work being machined and the size of the planer, for it is, of course, not advisable to operate the very large ones at a high rate of speed. In general, a roughing cut of 50 ft. per minute on cast iron is about all the tool steels will stand in planer practice. Certain grades of cast iron are being machined successfully at 70 ft. per minute, and tests have been made at much higher speeds, but it is believed that between 50 and 60 ft. per minute is as high as can successfully be used in general practice; in fact, it is higher than that usually recommended. A soft steel may be cut at higher speeds, but it is doubtful if a cutting speed higher than from 60 to 75 ft. per minute can be used to advantage on this class of work. The general opinion seems to be that finishing cuts should be taken at lower speeds, depending upon the accuracy required.

Variable cutting speeds are furnished by means of change gears, speed boxes, variable speed countershafts and variable speed motors. It is, of course, desirable to keep the return speed constant, and that the changes in speed be made with the least possible loss of time. Two or three changes of speed are all that the ordinary planer operator can use to advantage. Under the direction of a speed foreman it might be possible to use a greater number with good results.

One of the largest planer builders states that at present they are equipping about 75 per cent. of the planers over 36 ins. with motor drives, and from 25 to 30 per cent. of the smaller ones, and predicts that these percentages will be increased in the near future, due to the improvements which have been made in motors used for this purpose. Other builders report smaller percentages, but there seems to be no question as to the ability of the motors to successfully drive these machines. The planer manufacturers are watching closely the reversible motor drive, for if it proves successful, and the present indications are that it will, and is a commercial possibility, its use will greatly simplify the design of the planer itself.

ALTERNATING CURRENT SWITCHES.

With the growing use of induction motors there has been an increasing demand for a switch that may be placed at any point on a line of alternating current distribution and be operated from some distant point selected as the center of control. Heretofore it has been necessary where independent control was desirable to carry independent circuits of heavy wire, double or triple according to the phase, from the power house or central point of control to the various motors, transformers and other apparatus. The electrically operated switch illustrated in the photograph is designed to do away with this costly wiring. The design of the switch is such as to take advantage of the peculiarities of the alternating current solenoid, at the same time combining simple construction and a small size solenoid with positive and reliable action. The solenoid is actuated by a push button or small snap switch, which may be located at any distance from the point where the switch is installed.



SOLENOID SWITCH FOR ALTERNATING CURRENT.

An important application of this switch is in connection with auto starters or grid resistance starters for the operation of motors of large size used in connection with ventilating systems, plunger elevator systems, pneumatic tool equipment, or wherever it is desirable either to stop and start a motor from some distant point or automatically control it. Another important field for this apparatus is the throwing in and out of one or more transformers where there are several in a bank operating through certain hours of the day to their full capacity, but during the longer periods running on such light loads as to be very inefficient if they were all left in circuit. A solenoid switch placed in the circuit of each transformer enables the operator at the station to throw out as many as the load conditions warrant, or they may be arranged to operate entirely automatically as the load rises or falls. One or more of these switches may be used in central stations as synchronizers, as they work simultaneously from the switchboard regardless of the location of the switches. They may also be used to advantage in connection with traveling cranes, turn-tables, ventilating systems and cistern pumps operated by induction motors.

As the solenoid is in circuit only while the switch is closed, the current used is negligible, and the efficiency is high when compared with the line losses on independent power circuits. The apparatus is mounted on a slate panel which may readily be secured to any support; it is equipped with overload and underload safety devices, and has an oil gauge, which enables the attendant to see that the oil is at the proper level in the tank. The apparatus may be used where gas or combustible particles make it dangerous to have any sparking or arcing. The hermetically sealed type is proof against acid or other fumes which would corrode or disintegrate the parts. These switches are made by the American Electric & Controller Company, who have recently engaged etxensively in the manufacture of alternating current apparatus, in addition to their direct current work.

THE CARE OF PNEUMATIC TOOLS.

The following extract is taken from an article in *The Engineering Magazine* on "Systematization and Tool-Room Practice in Railway Repair Shops," by Mr. R. Emerson:

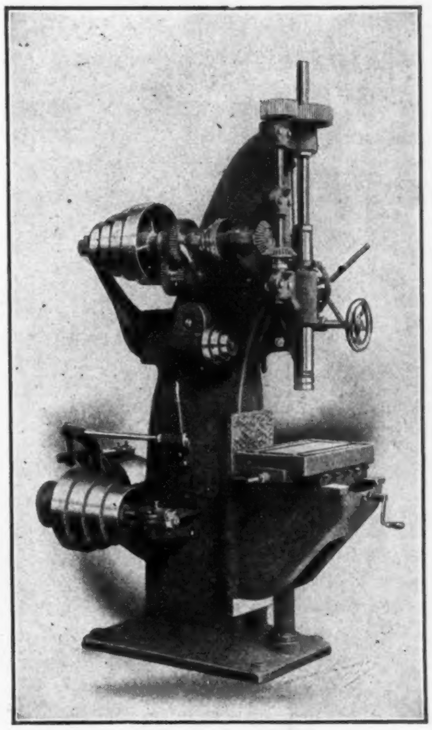
Railroads use tools of all kinds; it is difficult to say whether the investment in small tools or in machine tools is greater. While the former are individually cheaper, they may be collectively more costly. One of the most important features of small-tool equipment is the air-tool service. These tools for the money invested in them do giant's work, but on account of the severe strains to which they are put they suffer frequent disorders. Unless this branch of the service is rigorously supervised, constant trouble and vexatious delays will result. From figures in my possession, I find that the maintenance and repair charges on pneumatic tools range from 60 per cent. to 90 per cent. per annum on the purchase price of these tools, without counting the depreciation and interest charges, which in the case of tools with life so short as these are very high—I should say, combined, an additional 100 per cent. In fact, this maintenance and repair cost, together with the purchase price of the tool, will average somewhat above $200 per annum, this figure applying equally to motors and hammers. As it is false economy to do work by hand that can be done by air, and as there is much work that can be done more conveniently and cheaply with portable air tools than with stationary machine tools, the larger the number of air tools engaged in productive work the cheaper the output costs.

One large railroad company had its pneumatic-tool account rising steadily for the past five years, averaging over $15,000 per year for new tools and material and labor repair charges alone. This account had not been systematically looked after, tools being battered around the shop till it was no longer possible to effect simple repairs and adjustments, when they were sent to the manufacturers for thorough overhauling and replacement of parts. The practice obtained of men seizing what motors they could lay hands on and using them, often carelessly, until the machines would no longer give good service or run at all. There was practically no one to raise the question except the man using the machine or the shop foreman who was interested in the output of the work, or the tool-maker who was delegated to make repairs—each of these men being powerless to effect any reform or establish any system or incite any interest in the matter of properly handling these tools as a general proposition. But when the master mechanic himself awoke to the importance of this matter—because, on the one hand, of the curtailment of his requisitions for additional air-tool equipment, and because, on the other hand, of a long-drawn howl on the part of the shops for increased facilities in this direction—he set a special apprentice to work to see what could be done and saved by means of an efficient system. The net result of a system of holding men and foremen responsible for machines definitely assigned to their charge, together with the enthusiastic co-operation and

ingenious handling of the repair question by the tool-room foreman, was a reduction in cost to less than $5,000 per year, not counting interest, depreciation, and fixed charges. This saving represents the interest at 4 per cent. on $250,000. These figures take no account of the saving of the men's time due to increased use of air-tool equipment and more efficient performance of same in service, as these savings, being indirect, though great, could not be determined.

HIGH-SPEED VERTICAL DRILL.

The drill press shown in the accompanying illustration has been especially designed to withstand the heavy feeds and the high speeds that can be used with high-speed drills. It has a speed range of from 45 to 500 r.p.m., and is adapted for drills from ⅝ to 1½ ins. in diameter. It is equipped with a compound table, having screw adjustments in all directions, so that the work, when clamped, may be quickly and accurately centered on the drill or reamer. This arrangement has several advantages over the ordinary type of swinging table. It allows the column to be designed to much better advantage, and the connection between the column and the table may be made much more rigid, thus making it possible to do accurate work and at the same time use the heavy feeds with high-speed drills. It also obviates the difficulty experienced with the swinging table due to the split clamp getting out of alignment, thus causing work, when accurately centered, to draw away from the drill when the clamp is tightened up. By means of micrometers, which are provided, the holes may be accurately spaced without previously laying them out. This drill is made by Baker Bros., of Toledo, O.

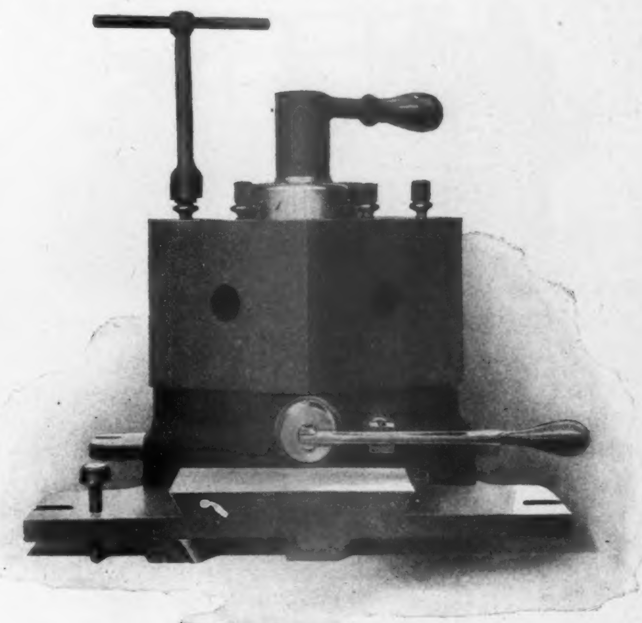


NEW HIGH-SPEED DRILL.

TURBINES VS. RECIPROCATING ENGINES.—A striking example of the difference in size, weight and speed between turbine and reciprocating engines of the same capacity may be seen in the power equipment of the Rapid Transit Company in New York. Turbine type generators with a rated output of 5,000 kw., weighing 234,000 lbs., run at 750 r.p.m. Generators of the same output driven by reciprocating engines at a speed of 75 r.p.m., weigh 980,000 lbs. Orders for 8 turbine generators have been placed with the Westinghouse Electric & Manufacturing Company in the past few days, mostly for 400 and 500 k.w. units, with one 2,000 k.w. and one 2,500 k.w. machine.

NEW TURRET FOR LATHE CARRIAGE.

The turret for a lathe carriage, shown in the accompanying illustration, is interchangeable with the regular compound rest, and is designed to have a stiffness and rigidity commensurate with the increase in power required by the new tool steels. The principal departure from the ordinary standard is in the plate on which the cross slide moves. This is made to slide onto the regular carriage dovetail, and is secured in place by four bolts in the tee slot of the carriage wings. The cross slide is made with a bearing about twice as wide as that of the compound rest. The plate is slotted, permitting the cross-feed nut to extend up and attach to the cross slide, so that the cross feed may be applied to the turret. As no movement of the plate takes place, the regular carriage dove tail is relieved of all wear. This turret was designed by the Lodge & Shipley Machine Tool Company to meet the growing demand for such a device.



NEW TURRET FOR LATHE CARRIAGE.

SMASHING MACHINE TOOLS.

A large manufacturing concern whose shops are filled with modern "up-to-date" machine tools, complains that in order to utilize the high speed steels to full advantage, machine tools are often broken. We were not surprised at this when we found cast steel being planed with a ½-in. feed and a depth of cut as great as ¾ in. in places. It is claimed by those in charge that there is great economy in working the machine tools at this rate in spite of the expense and inconvenience caused by breakages. Machine tools will have to be made still stronger to stand this kind of service. How can those in charge of our railroad shops justify their course of very carefully handling tools from 10 to 50 years old in order to make them last a little longer? The operators' wages are the largest item in the cost of turning out work and surely if shop managers would study the question from this standpoint old machine tools would be scrapped and efforts would be concentrated to increase the output of each machine in order to reduce the labor charge per piece to a minimum.

SCRAPPING OLD MACHINES.—It may be stated as a general proposition that if a new machine be invented which will, by increasing the output only 10 per cent., reduce the cost an equal amount, it pays to scrap the old machine.—*Mr. Alexander E. Outerbridge, Jr., Am. Academy of Political and Social Science.*

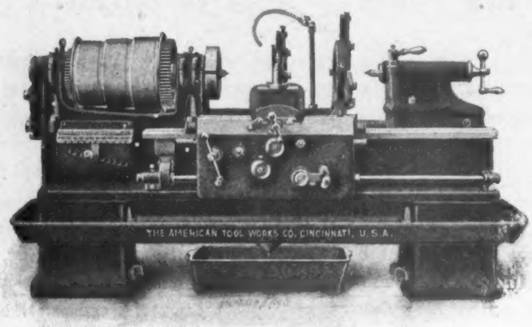


FIG. 1—18-IN. HIGH-SPEED MANUFACTURING LATHE.

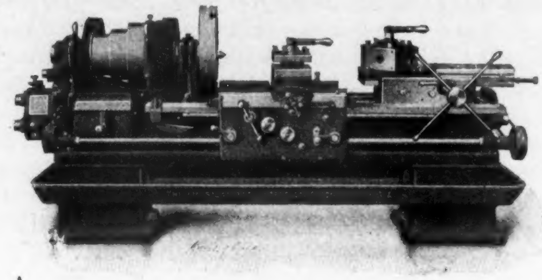


FIG. 3—20-IN. LATHE WITH FRICTION HEAD AND TURRET.

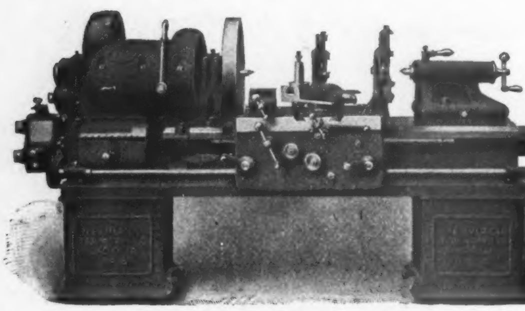


FIG. 2—20-IN. LATHE WITH ALL GEAR HEAD.

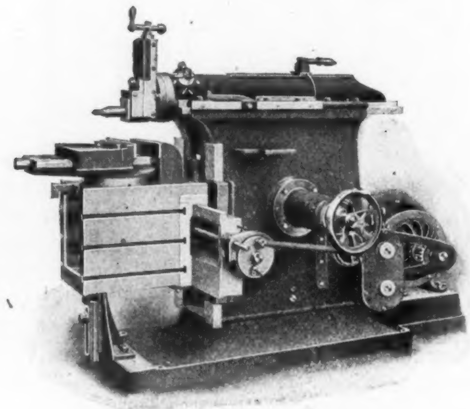


FIG. 5—24-IN. MOTOR DRIVEN SHAPER.

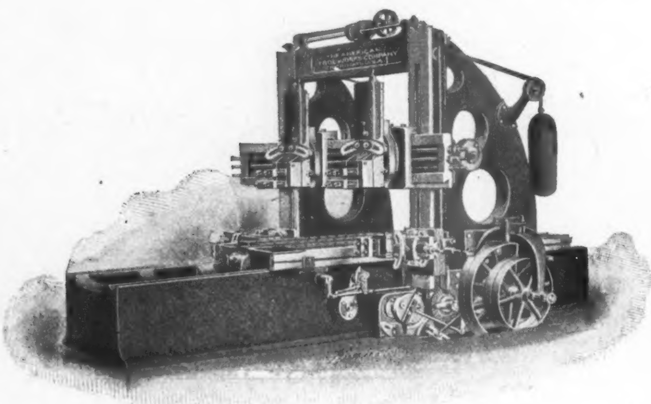


FIG. 4—48 BY 48-IN. PLANER.

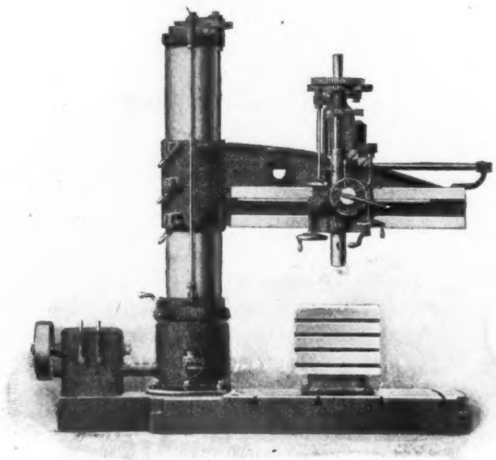


FIG. 6—4-FT. RADIAL DRILL.

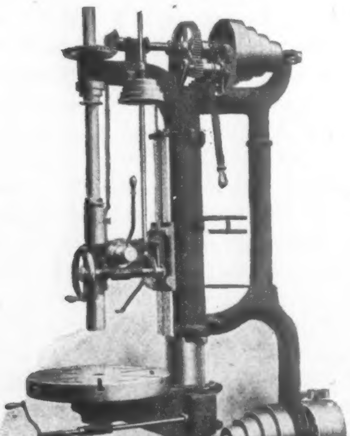


FIG. 7—25-IN. STANDARD DRILL.

A LINE OF MODERN MACHINE TOOLS.

Machine shop methods have advanced so rapidly during the past few years that the machine tool builders have not only found it necessary to completely redesign their line of tools, but from time to time have had to make radical changes in the new designs in order to keep up with the most advanced shop practice. The accompanying illustrations show some of the more recently designed machine tools made by The American Tool Works Company.

The 18-in. high speed manufacturing lathe shown in Fig. 1 is specially designed for the use of high-speed tools, and will maintain a continuous cutting speed of from 150 to 200 ft. per minute, depending on the nature of the material, on work from 1 to 4 ins. in diameter. It is driven by a 4-in. double belt, and this, with the large diameter of all three steps of the cone pulley, makes a very powerful drive. The design throughout is very strong and substantial, so that the limit of the work is at the tool rather than at the belt. Geared feeds are provided, which may easily be changed by means of the

handle under the headstock. A plentiful supply of water is forced on the cutting tool through the flexible tube.

The lathe shown in Fig. 2 has an all gear headstock, which is simple and efficient, and in addition to greatly increasing the power of the lathe and affording a quick and convenient method of changing the speeds, the expense of changing will be very small if at any time it is desired to change from a belt to a motor drive. Six steel cut gears, which have wide faces and coarse pitch, furnish four speed changes, and are operated by the two levers at the front of the head. These gears are completely housed in, thoroughly lubricated, and run at low pitch line velocities, thus reducing the noise to a minimum.

The lathe shown in Fig. 3 is equipped with a friction head, and has a turret mounted on the shears. The friction back gear may be thrown in or out of service instantly by shifting the lever at the front of the head. This feature is especially valuable in handling work requiring frequent interchange between the fast and slow speeds. The turret is equipped with power feed and, if desired, it may be placed on the carriage instead of on the shears, or be made round instead of hexagonal.

The heavy pattern 48-in. planer with four heads, illustrated in Fig. 4, is equipped with an improved shifting mechanism, which prevents the shrieking of the belts and reverses the table without shock or jar. The heads on the cross rail are made right and left, in order to permit of planing close together. The design throughout is such that the planer may be operated at comparatively high cutting and return speeds, and full advantage may be taken of the high-speed steels.

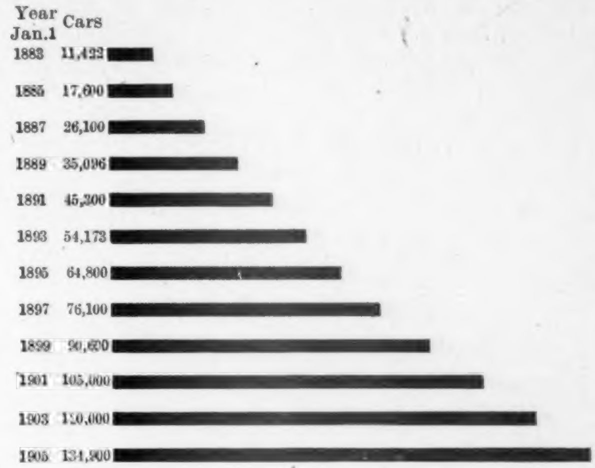
Fig. 5 illustrates a back geared crank shaper driven by a constant speed motor mounted on an extension of the base and connected by spur gears to the driving shaft of the speed box, which furnishes four speed changes. The back gear ratio is 24.3 to 1, thus allowing exceptionally heavy cuts to be taken. The design of the rocker arm and column is such that a 3¼-in. shaft may be passed under the ram for key-seating. The machine has been carefully designed, with a view to rapidly chucking and machining all classes of work, usually handled on this type of tool.

The 4-ft. radial drill shown in Fig. 6, which holds the record for rapid drilling, is of unusually heavy design, and is well adapted for the use of high-speed drills. It has a depth gauge and a trip which acts automatically at the full depth of the spindle, preventing breakage of the feed mechanism. The speed box of the geared friction type furnishes four changes of speed by means of the two levers; the spindle has sixteen changes of speed, arranged in geometrical progression from 16 to 267 r.p.m. The column is of the double tubular type, and the arm is of a parabolic beam and tube section, which gives the greatest resistance to the bending and torsional strains. A tapping mechanism is carried on the head.

The column of the 25-in. upright drill press shown in Fig. 7 is of large diameter, and is firmly braced at the back, thus giving the drill exceptional solidity and stiffness. The spindle has a patent quick return, and the automatic stop to the down feed is set by graduation on the spindle and is readily adjusted.

PROGRESS IN PINTSCH CAR LIGHTING.

The carefully kept statistics of the Julius Pintsch Company, of Berlin, showing progress in the application of gas for car lighting, are always interesting. At the present time 134,855 cars, 6,191 locomotives and 1,516 buoys and beacons are equipped with this system of lighting; in conjunction with which 364 special gas works have been equipped to manufacture and compress the gas. During the year 1904 3,084 cars and 60 buoys and beacons have been equipped in the United States and Canada with the Pintsch lighting system, 1,6[illegible]4 cars having been equipped with the Safety Car Heating and Lighting Company's standard system of steam heating. Pintsch lighting has been adopted by over 200 railroads of the United States, Canada and Mexico, where it has been applied to 25,000 cars and 450 buoys and beacons. The steam heating systems of this company have been adopted by over 150 railroads in the United States and applied to 16,000 cars. The simplicity of operation and the economy of maintenance

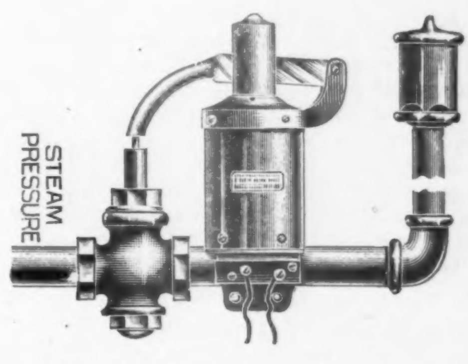


PROGRESS IN PINTSCH GAS LIGHTING.

of this system has caused it to be adopted as standard by a majority of the railroads and lighthouse departments of the world. A graphic illustration of the progress of Pintsch lighting is presented in the accompanying diagram.

ELECTRICALLY OPERATED WHISTLE VALVE.

This is a device whereby an air or steam signal whistle may be operated at any distance, by the pressure of a button located at any desired point. In a large shop or yard such a device is invaluable in calling foremen to the telephone. The engraving illustrates the standard type for all ordinary pressures of steam. Any voltage of either direct or alternating current may be provided for in the winding of the actuating solenoid. Any whistle up to 3-in. diameter may



ELECTRICALLY OPERATED WHISTLE VALVE.

be operated at pressures of from 75 to 150 lbs., and when provided with a larger valve, 6-in. whistles may be operated. The action of the solenoid is to draw down the iron cone and press down the curved lever, which opens a small pilot valve under the main valve, admitting steam to the expansion chamber above. The main valve is balanced, and further motion of the lever opens it, operating the whistle. A spring seats the pilot valve when the current is turned off, and another spring raises the solenoid plunger when out of action. The device may be used with the Churcher alternating rectifier, which converts alternating into direct current of any required voltage. At the Wilmington shops of the Pennsylvania Railroad eight of these whistles are used in the fire alarm system. At the works of the Lodge & Shipley Machine Tool Company, Cincinnati, O., a whistle has been in use nearly two

years, and enables the office to signal any of the foremen or engineers, thus saving a great deal of time in finding them. It is used in connection with their private telephone system. Further information may be obtained from the Churcher Electric & Manufacturing Company, Cincinnati, O.

FALLS HOLLOW STAYBOLTS.—A large order for this iron has been received from the Western Australian Government Railways and also from the Cuba Company for an important railroad in Cuba.

BOOK NOTES.

CIVIL ENGINEERS' CLUB OF CLEVELAND.—A souvenir book giving the history of the organization, with photographs of past presidents, has been received from Mr. J. C. Beardsley, secretary of the club.

Ferric and Heliographic Processes; a Handbook for Photographers, Draftsmen and Sun Printers. By George E. Brown. Published by Tennant & Ward, 287 Fourth avenue, New York. 1905. Price, $1.

This little book of 150 pages is devoted entirely to methods of reproducing drawings from tracings. It presents the subject comprehensively, and includes complete descriptions and examples of various sun printing methods. It is surprising to find that there are so many good processes.

Transactions of the American Society of Mechanical Engineers. Vol. xxv, 1904. Report of the 48th and 49th meetings of the Society. 1,155 pages. Published by the Society from the Library Building, 12 West Thirty-first street, New York City.

Among the papers of special interest to our readers are: "What Are the New Machine Tools to Be," by John E. Sweet; "Road Tests of Consolidation Freight Locomotives," by E. A. Hitchcock; "Testing Locomotives in England," presented by the Institution of Mechanical Engineers; "Experiments with a Lathe-Tool Dynamometer," by J. T. Nicholson, and "Locomotive Testing Plants," by W. F. M. Goss.

Webster's International Dictionary. Published by G. & C. Merriam Company, Springfield, Mass. Price, $10.75.

This is a new and enlarged edition, printed from new plates, and contains a supplement of 25,000 additional words, a completely revised gazeteer of the world, a completely revised biographical dictionary and other improved and enlarged departments. It is impossible to "review" such a work. It is sufficient to state that in the office or the library this new edition is indispensable to those who desire to use the English language correctly. In the publication office of this journal the gazeteer alone is worth many times the price of the work. It is a truly International dictionary, and yet has not lost any of its value as an American dictionary. The words are easily found, the pronunciations are given, the meaning is clearly stated, and the growth of words is traced. It is a wealth of words, and is especially strong in scientific terms, the lack of which has been a weakness in previous works of the kind.

Elements of Mechanics: Forty Lessons for Beginners in Engineering. By Mansfield Merriman, Professor of Civil Engineering, Lehigh University. 172 pages, illustrated. Puplished by John Wiley & Sons, 43 East 19th street, New York. Price, $1.

This work presents the subject of mechanics in an elementary way. The work is closely associated with experience "by which alone the laws of mechanics can be established." It contains many numerical illustrations and problems, as exercises for the student. The author of this work believes it to be necessary to divide mechanics into two courses, one being elementary for the freshman year and the other advanced, after completing calculus. He believes the principles and fundamental methods to be vitally necessary and the present work deals with the subject without higher mathematics. Knowledge of calculus is indispensable to a complete knowledge of mechanics, but as most students wait for the calculus before taking up the subject seriously many who might understand the principles miss mechanics altogether. Professor Merriman intends this book for manual training schools and freshman classes in engineering colleges, this to form a foundation for an advanced course later on. The book meets a definite need and it carries out the idea of the author admirably.

PERSONALS.

Mr. W. S. Murrian has been appointed master mechanic of the Southern Railway at Spencer, N. C.

Mr. J. T. Stafford has been appointed assistant master mechanic of the Pere Marquette Railway at Grand Rapids, Mich.

Mr. W. F. Kaderly has been appointed master mechanic of the Southern Railway, with headquarters at Alexandria, Va.

Mr. E. S. Fitzsimmons has been appointed general master boiler maker of the Erie Railroad, with headquarters at Meadville, Pa.

Mr. W. D. Lowry has been appointed master car builder of the Cincinnati, Hamilton & Dayton, with headquarters at Lima, O.

Mr. F. A. Delano has been elected president of the Wabash, Pittsburg Terminal, to succeed Mr. Joseph Ramsey, Jr., resigned.

Mr. J. F. Fleischer has been appointed master mechanic of the Chicago & Northwestern, with headquarters at Sioux City, Iowa.

Mr. H. B. Sutton has been appointed master mechanic of the Newton & Northwestern Railroad at Boone, Ia., to succeed Mr. L. L. Collier.

Mr. C. H. Weaver has been appointed supervisor of air brakes of the Lake Shore & Michigan Southern, with headquarters in Cleveland.

Mr. Thomas Marshall has been appointed master mechanic of the Chicago, St. Paul, Minneapolis & Omaha Railway, with offices at St. Paul, Minn.

Mr. G. A. Gallagher has been appointed master mechanic of the Illinois Southern Railroad, with headquarters at Sparta, Ill., to succeed Mr. R. J. Farrell, resigned.

Mr. J. F. Sheahan has been appointed master mechanic of the Southern Railway at Atlanta, Ga., having been transferred from Spencer, N. C.

Mr. J. T. Robinson has been appointed acting master mechanic of the Seaboard Air Line at Savannah, Ga., to succeed Mr. A. J. Poole, transferred.

Mr. W. S. Murray has been appointed electrical engineer of the New York, New Haven & Hartford Railroad, with headquarters at New Haven, Conn.

Mr. W. J. Hoskins has been appointed master mechanic of the Chicago & Eastern Illinois Railway at Danville, Ill.

Mr. F. H. Weatherby has been appointed master mechanic of the Tacoma Eastern, with office at Bismarck, Wash., to succeed Mr. Robert Bagley.

Mr. John H. Fulmer has been appointed master mechanic of the Schuylkill Division of the Pennsylvania Railroad, with headquarters at Mt. Carbon, Pa.

Mr. H. H. Maxfield has been promoted from the position of assistant engineer of motive power of the Pennsylvania Railroad at Jersey City to that of master mechanic at Trenton, N. J.

Mr. E. D. Andrews has been promoted from the position of road foreman of the Chicago, Rock Island & Pacific at Shawnee, Oklahoma, to that of master mechanic, with headquarters at Dalhart, Texas.

Mr. S. M. Dolan, master mechanic of the Southern Railway, has been transferred from Atlanta, Ga., to St. Louis, Mo.

Mr. S. C. Graham has been appointed master mechanic of the Chicago & Northwestern, with headquarters at Kaukauna, Wis., being transferred from Lake City.

Mr. O. J. Kelley, master mechanic of the Baltimore & Ohio, has been transferred from Parkersburg, W. Va., to Grafton, W. V., to succeed Mr. W. S. Galloway, promoted.

Mr. R. E. Smith, assistant to the general manager of the Atlantic Coast Line, has been appointed general superintendent of motive power, with headquarters at Wilmington, N. C.

Mr. W. F. Dasch has been appointed master mechanic of the Annapolis, Washington & Baltimore Railway, with headquarters at Annapolis, Md., succeeding Mr. J. L. Beall, resigned.

Mr. P. S. Hursh has been appointed general boiler inspector of the New York, New Haven & Hartford Railroad, with head quarters at New Haven, Conn., succeeding Mr. E. S. Fitzsimmons.

Mr. Charles W. Allen has been appointed assistant to the superintendent of motive power of the Philadelphia & Reading, with headquarters at Reading, Pa. He will have charge of the shops of the road.

NEW CATALOGS.

IN WRITING FOR THESE CATALOGS PLEASE MENTION THIS PAPER.

ALTERNATING CURRENT SOLENOID SWITCHES.—Bulletin No. 3 from the American Electric & Controller Company, New York City.

SUPPLIES AND CAR SPECIALTIES.—Catalog No. 153 from the J. G. Brill Company, Philadelphia, Pa., describes the various specialties made by them.

DRILL GRINDERS.—Catalog No. 90 from Wilmarth & Morman Company, Grand Rapids, Mich., describes the various styles of the "New Yankee" drill grinder.

SMALL BELTED MOTORS AND GENERATORS.—Bulletin 51 from the Crocker-Wheeler Company, Ampere, N. J., describes their form F machines and illustrates several typical applications.

JACKASS POWER.—A small pamphlet from the Lucas Machine Tool Company, Cleveland, O., which pointedly emphasizes the advantages of their power forcing press.

FAN MOTORS.—Two folders from the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., describing their desk and wall types of fan motors, for direct and alternating current circuits.

MACHINE TOOLS.—A large, loose leaf catalog from The American Tool Works Company, Cincinnati, O., describing their complete line of machine tools, which includes lathes, shapers, planers and vertical and radial drills.

CRANE SEPARATORS.—The Crane Company, Chicago, have issued an advance circular describing their steam and oil separators made in sizes from 1 to 30 ins., and in horizontal, vertical, angle and distributing types. Copies may be had by asking for "Advance Circular No. 01."

JACKS.—This is the title of a 24-page pamphlet by the Buda Foundry and Manufacturing Company, of Chicago, illustrating their ratchet, friction and ball-bearing jacks for track, bridge, locomotive and car works. Lists of repair parts and information concerning size, weight and capacity of each style are included.

PLANER DRIVES.—Bulletin No. 47 from the Northern Electrical Manufacturing Company, Madison, Wis., contains a reprint of two articles by Mr. J. C. Steen on tests of motor-driven planers which appeared in the August and September, 1904, issues of this journal. The bulletin is illustrated with several applications of Northern motors to planers.

PORTABLE TOOLS.—The various portable tools for railway repair shops made by H. B. Underwood & Co., Philadelphia, Pa., are very completely described in their 1905 catalogs.

FALLS HOLLOW STAY BOLT COMPANY.—Under the heading of "Irrefutable Evidence," this company has issued a 32-page pamphlet concerning their staybolts and staybolt material. It opens with an introductory chapter describing the material and stating its use. This is followed by observations by Mr. John Livingston and by 15 pages of reports of experience and tests of hollow staybolts on a large number of railroads. A list of 77 railroads are enumerated in a partial list of customers. The second part of the pamphlet contains similar letters and reports from leading marine and stationary boiler manufacturers. This company has gone into the subject of staybolt iron exhaustively and has accumulated valuable information. Copies of this pamphlet will be sent to any railroad man making application for it.

CAREY'S ROOFING PRODUCTS.—The Philip Carey Manufacturing Company, Lockland, Cincinnati, Ohio, have issued a number of illustrated pamphlets describing their specialties. One is devoted to 85 per cent. magnesia locomotive lagging for locomotive boilers. This pamphlet contains a number of excellent engravings of well known locomotives and discusses the merits of magnesia lagging for protecting the boilers. It also deals with its use for steam pipe coverings. Two other pamphlets on magnesia illustrate its application to steam pipes and boilers and includes a number of asbestos packing specialties. A larger pamphlet entitled "Carey's Magnesia" contains illustrations showing the application of this pipe covering in some of the best known power stations and buildings in the country, including such buildings as the St. Regis Hotel, New York City, and ships of the United States Navy. The Carey roofing is described in another pamphlet, which illustrates its method of application and discusses its merits and fireproof qualities. An additional pamphlet contains testimonials from individuals, firms and corporations using the Carey products.

NOTES.

MAGNUS METAL COMPANY.—This Company has moved its executive offices to Suite No. 1014, Trinity Building, No. 111 Broadway, New York.

AMERICAN LOCOMOTIVE COMPANY.—This company has removed its offices from the Broad Exchange Building to the Trinity Building, 111 Broadway, New York, where they will occupy an entire floor.

LOCOMOTIVE APPLIANCE COMPANY.—New offices of this company have been established in Suite 400, Old Colony Building, Chicago, where correspondence should be addressed. A cordial invitation is extended for friends to call "early and often."

The American Nut & Bolt Fastener Company have removed their general offices to their new factory, corner of Ridge avenue and Rebecca street, Allegheny, Pa., where they have increased their output to five times its amount when in the old quarters. The plant is equipped with new and modern machinery built specially for the manufacture of the Bartley fastener. This company reports that their books are filled with orders.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.—The South Side Elevated Railway Company of Chicago has contracted with this company for complete equipments for seventy cars, which includes multiple control apparatus and one hundred and forty 75-h.p. motors. The motors are of special design, and are in line with the re-equipment of this system. The cars will be operated in trains of five, three of which will be motor cars.

CROCKER-WHEELER COMPANY.—Mr. A. C. Bunker, formerly connected with the Stanley Electric Manufacturing Company, and Mr. W. C. Appleton, formerly with the General Electric Company, have become associated with the engineering and contract departments, respectively. Both of these gentlemen are alternating current engineers, and have been added to the force to take care of the rapidly increasing business in this line.

ADREON & COMPANY.—This company announces that they have secured exclusive selling rights, covering the railroads of the United States, for "Anti-Selenite Boiler Scale Solvent." This is a vegetable compound manufactured in Monterrey, Mexico. It is claimed to be remarkably effective in removing scale under all conditions and to protect the metal of the boilers. This solvent received a gold medal at the Louisiana Exposition. Further information may be obtained from Adreon & Company, Security Building, St. Louis, Mo.

DIAMOND CHAIN & MANUFACTURING COMPANY.—Mr. L. D. Bolton, heretofore Chicago representative of the Federal Manufacturing Company, is now with the Diamond Chain & Manufacturing Company of Indianapolis, and will represent that company in the Middle and Western States.

WELLMAN-SEAVER-MORGAN COMPANY.—Mr. Geo. B. Damon, manager of the New York office, has been transferred to an important position in the engineering and sales department at Cleveland. Mr. W. A. Stadelman, formerly of the Brown Hoisting Machinery Company, has succeeded Mr. Damon as manager of the New York office at 42 Broadway.

THE NILES-BEMENT-POND CO.—This company has leased an entire floor in the new Trinity Building, at 111 Broadway, New York, and will be located there after May 1st. The executive offices have been located in New York since the organization of the company under its present title. The Niles-Bement--Pond Company employs about 5,000 workmen, and has two factories in Philadelphia, one in Hamilton, Ont.; one in Plainfield, N. J., and it also owns the Pratt & Whitney Company at Hartford, Conn., thus constituting this company the largest builder of iron-working machinery in the world.

AMERICAN WATER SOFTENER COMPANY.—This company, of Philadelphia, Pa., reports that the Norfolk & Western Railway has just placed with them an order for a water softening plant having a capacity of 250,000 gallons per day, for the roundhouse at Columbus, O. This is to replace a 100,000-gallon per day plant installed a year ago, but which is too small for the present requirements. The company also reports that installations of the Bruun-Lowener water softener have been made on railroads in the United States, Argentine Republic, Chile, Spain, Denmark, Sweden and Russia, while the installation among industrial plants covers practically every country on the globe.

NOVEL INDUSTRIAL BENEFICIAL ASSOCIATION.—The shop employees of the Crocker-Wheeler Company have organized a beneficial association. Every employee who pays 10 cents a week to the association will be entitled to $10 a week for 20 weeks during incapacity through illness. If he dies, his family will receive $100. The payment of 20, 30 or 40 cents a week entitles him to $15, $20 or $25 respectively, with death benefits of $150, $200 or $250. The company contributes an amount equal to the dues paid to the association. Thus, if $6,000 are paid yearly in dues, the income of the association will be $12,000. The company does not require representation in the association, which will be run entirely by the employees.

CHICAGO PNEUMATIC TOOL COMPANY.—Mr. J. W. Duntley, the president of this company, sailed for Europe April 18th, taking five styles and sizes of electric drills for the trade of the Consolidated Pneumatic Tool Company, an important demand having developed for this class of tools. Tests will be made to demonstrate their performance. The business of the Chicago Pneumatic Tool Company is better than it has ever been. The month of March last was the best month since May, 1903. In April, up to and including the 18th, the increase in the number of tools sold over corresponding days of the month of March was 49 per cent., and an increase of 222 per cent. over corresponding days of April, 1904. Foreign business has also increased. Altogether, the present year seems likely to be the best in the history of the pneumatic tool business.

STURTEVANT GENERATING SETS.—The rapid advance of the B. F. Sturtevant Company, Boston, Mass., in the electrical field has been noticeable, and is practically marked at this time by the issue of their Bulletin No. 63, showing various types and sizes of generating sets. These range from 3 to 100 k.w., the smallest size being driven by a 3½ x 3 vertical engine, and the largest by a 14 x 14 horizontal center-crank engine. A separate series, ranging from 7½ to 100 k.w., is equipped with vertical compound engines. All the types of Sturtevant engines illustrated are completely inclosed and arranged with watershed partitions, to prevent the water from the piston rod stuffing box reaching the interior of the frame. All interior bearings are supplied with oil under a system of forced lubrication, thereby securing a mechanical efficiency considerably in excess of 90 per cent. Many of these generating sets in the vertical simple and compound types have been designed to meet the rigid specifications of the United States Navy Department, and their successful passage through the inspector's hands appears to be the best evidence of the standard which is being maintained by this company.

LARGE POWER UNITS.—The Administrative County of London and District Electric Power Company, which is responsible to a committee of the British House of Lords, is planning to construct three electric plants for generating current to supply the whole of London and those suburbs controlled by the London County Council. Each plant is to consist of six turbo-generators, each of 10,000 k.w. normal and 20,000 maximum capacity, making a maximum total of 360,000 k.w. As these power units are larger than any ever constructed, experts have been appointed to decide upon the practicability of units of this size. The electrical expert chosen for this important problem is Mr. C. F. L. Brown, of Brown, Boveri & Cie. The Crocker-Wheeler Company, American licensees, should be gratified by this mark of confidence in the ability of Mr. Brown.

STANDARD ROLLER BEARING COMPANY.—Mr. S. S. Eveland, vice-president and general manager of the Standard Roller Bearing Company, has purchased for that company the machinery, merchandise, assets and good will of the steel ball business of the Federal Manufacturing Company, of Cleveland. This transaction, which was for cash, amounted to a quarter of a million dollars. The Federal Manufacturing Company has manufactured steel balls for twenty years, and has the largest factory for that purpose in the world. The Standard Company bought the business of the Grant Ball Company a year ago, and since then has made from 4,000,000 to 5,000,000 balls per week. With the Federal Company's facilities moved to Philadelphia, the capacity will be increased to 500,000,000 balls per year. The extensive plant in Philadelphia has been enlarged to accommodate the additional machinery. Mr. Robert H. Grant, formerly of the Grant Ball Company, is superintendent of the Standard Roller Bearing Company; Mr. Thomas J. Heller is manager of the ball sales department; Mr. F. M. Germane is Western sales manager in Chicago, and Mr. S. S. Eveland is vice-president and manager. All of these gentlemen have had exceptional experience in the manufacture of ball and roller bearings.

REMOVAL OF AMERICAN STEEL FOUNDRIES.—The executive offices of the American Steel Foundries until lately were located at No. 74 Broadway, New York. With the object of concentrating all of the departments, it was found necessary to lease the entire eleventh floor of the recently completed building known as No. 42 Broadway, and henceforward communications should be sent to this new address. It is well known that in the new movement towards consolidation of allied industries one of the chief elements of success involves the systematizing and harmonizing of every branch of the business. With this end in view, the executive officers of the American Steel Foundries are inaugurating, simultaneously with the removal, a new system of accounting and distribution of orders, which will improve the organization and simplify their work. This will assist them in taking care of the many large orders they are receiving due to the increased demand for new equipment by the railroads and other large producers. The output of their eight plants for all kinds of steel castings is enormous, and they are always in a position to undertake new work and make prompt deliveries. With the acquisition of the Simplex Railway Appliance Company, they are even better equipped than ever to fill the requirements of railroad companies and car builders.

PHILIP CAREY MANUFACTURING COMPANY.—This company has recently completed a new roofing factory at Lockland, Ohio, which is one of the largest and best equipped roofing plants in the United States. The company was established in 1873 and has made a specialty of roofing manufacture in connection with a development of Carey's magnesia flexible cement roofing, which is well known among railroads, mining and construction companies and builders generally. The body of the roofing consists of a solid, flexible asphalt cement composition, tempered in the process of manufacture to a degree to enable it to resist wide ranges of temperature and adapting it to extreme northern or southern climates. The asphalt body is also protected by the construction of the roofing against the action of fumes, gases, heat and steam. It is stated to be less expensive than slate, tin, tar or gravel, and tests made at the insurance engineering experiment station by insurance experts resulted favorably for this roofing. It is used for both flat and steep surfaces and requires only ordinary careful labor for satisfactory application. Another important branch of this company's business is the manufacture of Carey's freight car roofing, which is made in 60-in. widths. This car roofing is designed to resist variations of temperatures as well as the jarring and motion of the cars of this severe service. The general offices and factories are located at Lockland, Cincinnati, Ohio.